AMERICAN MACHINIST

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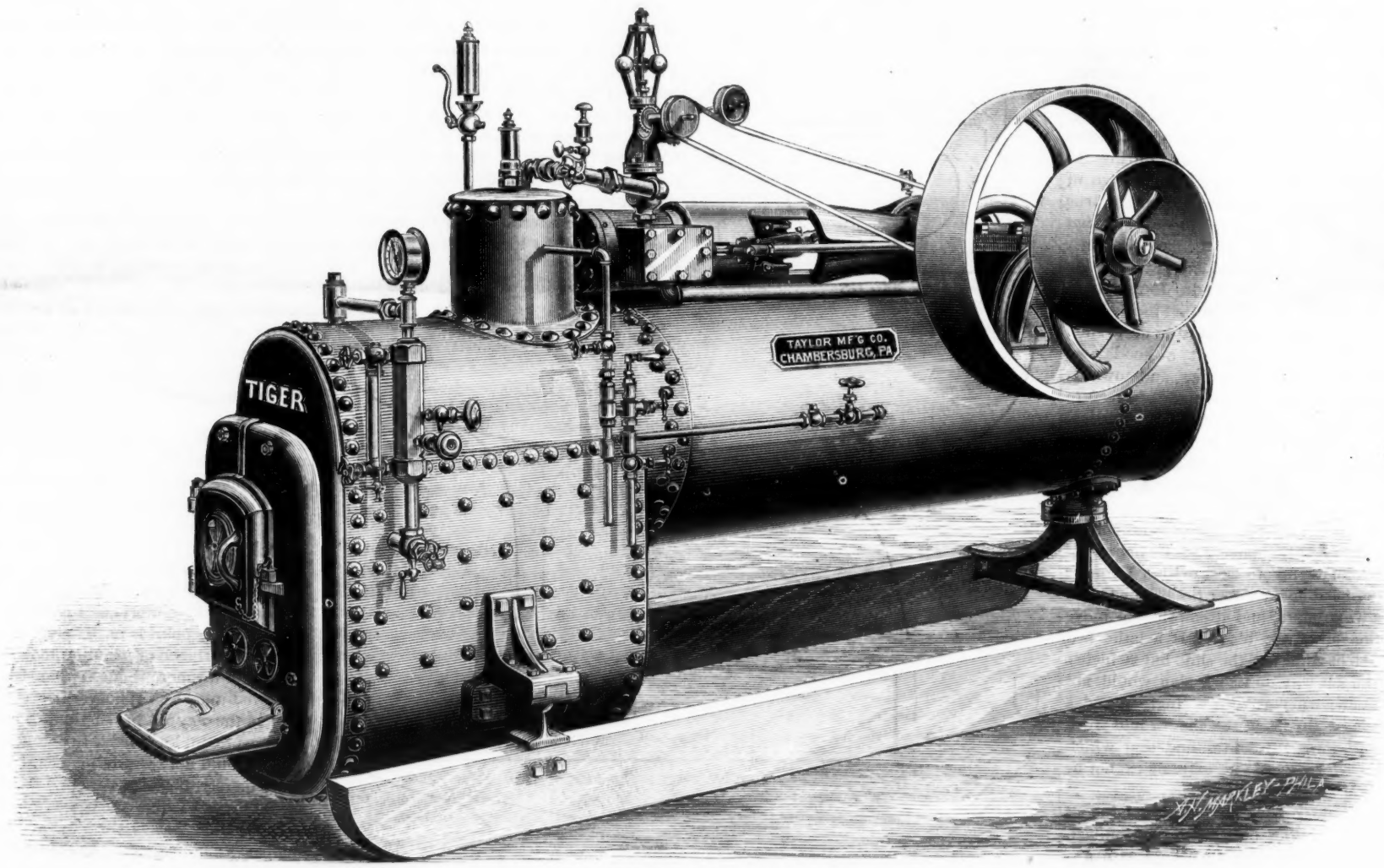
The New "Tiger" Engine.

The engine illustrated on this page has recently been designed by the Taylor Manufacturing Company, Chambersburg, Md , to meet the demand for a well-built and serviceable engine, that can be produced and sold for less than a center-crank engine. They have so arranged the bed-frame that its bearings on the boiler are nearly the same as the center crank, on the *top* of boiler instead of on its side, as in case of many side-bed engines. The frame is made in a solid piece, of approved modern girder frame, and is very stiff and strong in design. Cylinder and guides cannot get out of line. The cross-head is made with gibs on each side, which are held in place by a single bolt, and can be adjusted with ease to take up all wear. The cross-head pin, which is of forged steel, is also made so that all wear can be taken up, and the connecting-rod is made of best forged iron, polished, and, in all sizes up to 12-horse power, has solid ends with brass bearings easily adjusted. The larger sizes are made with straps, crank ends square ended, with two bolts and key, same as adopted on railroad locomotives. The crank-shaft is made of best forged steel, with a balanced disc and a forged steel crank-pin. They use hydraulic pressure to force the crank-pin and crank-shaft into the disc, thus insuring accuracy and preventing the danger of a loose disc or crank-pin.

The bearings for the crank-shaft are long and close together, thus giving extra strength with no chance to spring. They are so made that any wear in the boxes is easily adjusted and taken up. The crank-pin is made large to guard against heating. The valve, which is of the *D* pattern, is so constructed that it is free from any danger of cocking or getting away from the steam ports. Steam ports are large and distance short to the cylinder, giving good results for a quick-acting engine. An adjustable packing that requires no attention is fitted to the cylinder. The governor has stop motion, with speeder and Sawyer's valve attachment. Automatic oilers are used on the connecting-rod. No pump or heater is on this engine, but in their place is used the Hancock Inspirator. Boilers are made of best boiler plate, such as is used by the leading railroad shops of the country for locomotives. The waist of the boiler has a 5-inch lap, with a double row of rivets around it. The crown sheet is stayed by angle iron made in the shape of a bridge-truss riveted to the boiler every 4-inches square, and securely braced to the shell, and the sides of the fire-box are stayed every 4½ inches. It is claimed that this boiler is built just as well, in every respect, as boilers that are built for railroad locomotives. The mountings of this engine are so arranged that it may be transferred from skids to wheels or from wheels to skids without any change of castings on the boiler.

The company manufacture this engine from two to twenty-horse power, on skids and on wheels; also manufacture the same engine for stationary use.



SEMI-PORTABLE STEAM ENGINE.

Mechanical Drawing.

BY PROF. JOHN E. SWEET.

As a supplement to my illustrations of the old and new styles of lathe beds, one who has been a student of the subject for a long time, and who evidently thinks he can handle curves when put to it, sends the sketch shown in Fig. 60 (page 2) of a new style, and one that has these merits, if no others: It is new and is consistent.

That the bed is strong for the amount of metal there is no dispute; that it is very nearly correctly supported is evident; and if, as one of our most prominent New England engineers says, "no one has a right to make things ugly," this (if a combination of graceful curves, under all circumstances, are lovely) must be a neater design than those heretofore shown. I rather fancy that our Philadelphia friends will question whether it is a design for a lathe or a plan of some new-fangled washing machine, and wonder if any one has the courage to bring out such a design. It is only carrying out the New England notion to its fullest extent; and, if the designer has the ability to harmonize the necessary brackets for carrying gear studs, screw, apron, etc., he may hit a certain demand for what a large number think the true and beautiful in machine construction. I have given the design more to illustrate a principle involved in designing, than for any merit in the thing itself.

In Fig. 61 (page 2) I have drawn the outline of the curves simply to show that they would, if continued, all blend together, and in this one feature is embodied one of the great differences between good and bad designs. One place where this may be seen in all machine shops is in the skeleton back supporting rig to nearly every modern upright drilling machine; seen in its greatest perfection in the drilling machine built by Wm. B. Bement & Son, of Philadelphia, and in its greatest ugliness in the designs of some half-dozen other builders, where worst of all is hard to determine.

In the above use of the word "design," I refer wholly to the looks of the thing, and in no way to the question of utility.

From the letters that have appeared in the AMERICAN MACHINIST since the first sketches of lathe beds were sent (in which many of the writers strongly favor flat ways in preference to inverted V's) it would appear that there is an opportunity for a lively discussion, as the plan I advocated in the lathe bed article was of a different kind. So far as changing the opinions of those who advocate one or another plan, no amount of argument is likely to do that, but the argument

presented on either hand is valuable to those who have no preference, and the young draughtsman cannot better employ his time than in reading what all hands have to say. The question of slides is an important one in machinery, and the man who knows just when to put ∧'s and dovetails, flat surfaces and square ledges for this or that special work has got a long way on the right road.

The advocates of the flat-top bed or shears claim that it is more rigid, has more wearing surface, and will therefore keep true longer, and that they run easier.

That the Philadelphia flat-bed lathes have been made heavier than the New England ∧ style is no evidence that there is anything stronger or stiffer in one plan than the other. That there is more wearing surface on the flat than on the ∧ is simply because they are so made. If the ∧ is large enough and the slide rest long enough, then there may be just as much wearing surface in one case as in the other. As to one going easier than the other, according to the laws of friction—with equal weight and equal lubrication—one ought to go just as easily as the other. But according to the law of grease and dirt, the man with the New England lathe generally gets around twice while the Philadelphia chap is trying to jigger his slide rest along so he can get it greased up.

To say that the slide with a large wearing surface will wear longest is to admit that they will wear; to admit that, is to admit that they wear most at the head stock end. When that occurs, the slide rest guided by the back and front of the bed must be either too loose at the head stock or too tight at the foot stock end, while the slide rest, guided by a single ∧ in front (large enough to give ample surface, flat enough to prevent wedging, and with a slide long enough to insure truth) will run free from shake during the lifetime of the lathe, and wearing down of the ∧ does not throw the slide out of true alignment to but one half the extent that wearing away the back of the flat bed does.

On general principles, it is best to get the wearing surface at right angles to the pressure. At first it would seem that the flat way does this, but in fact the pressure on a slide is not directly down, but a good deal towards the front in turning, and towards the back in boring. If the angle of pressure is as much as 22½ degrees from the vertical (as it likely is in many cases) then the flat way is no nearer to a right angle with the pressure than the 45 degree angle ∧.

Guiding a slide rest by the back edge of a lathe bed while the resistance and propelling power is in front, seems to me no more consistent than trying to work with a T square with the head hooked over the back edge of the drawing board, and attempting to move it by the end of the blade. If a lathe bed were 20 feet wide, and the slide but 20 inches long, the flat way on two ∧ plan would not work at all; whereas with a single ∧ and a flat slide at the back, the slide would work if the lathe was any width, and that which is bad when carried to an extreme cannot be the best at any scale.

Because there have been any number of good strong lathes built with flat top bed, and lots of ridiculously weak ones with ∧'s, it does not follow that the ∧'s are the cause of the weakness.

However much I may argue about the flat bed as being a poor way to guide a slide rest, I think it the height of wisdom compared to the two ∧'s. The only argument I ever heard in favor of the two ∧'s was, that in case of great thrust against the tool towards the front of the lathe, the thrust is taken by both the front and back slides of the bed, but cross girts accomplish this in a better way, and besides when the strain is so great as to seriously affect the back, it will lift the back of the slide rest off the ∧, so it can do no good. To get the two ∧'s perfectly parallel is a difficult and costly job, and to have them out of truth makes the worst of all conceivable arrangements.

Combining what I take to be John Richard's idea of a box bed with my own idea of a single ∧ and one flat slide arrangement, the section of the bed would assume the form shown in Fig. 62 or 63, though the special features may be explained to a better purpose in steadying the slide rest.

As another lesson in drawing, the apprentice can take the foot-stock of the lathe and in advance think over the requirements.

It has to resist strains in these directions: direct from the head-stock in drilling, up from the resistance of the cutting tool, and back from the pressure of a dull cutting-off tool, and from all tools set above the center.

The foot stock should resist these strains in the best possible manner, and be as light as is consistent with strength that it may be freely moved. It should be made fast to the bed, be freed, moved and again fastened by the simple action of one hand.

The spindle should be made fast or free without change of alignment, and the screw that moves the spindle should remain in any position without fastening.

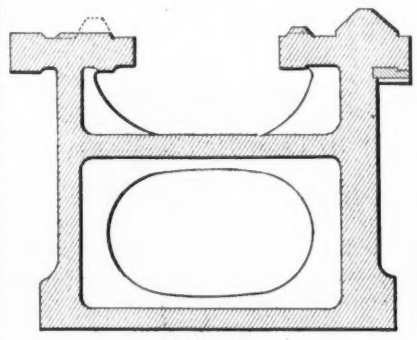


Fig.62

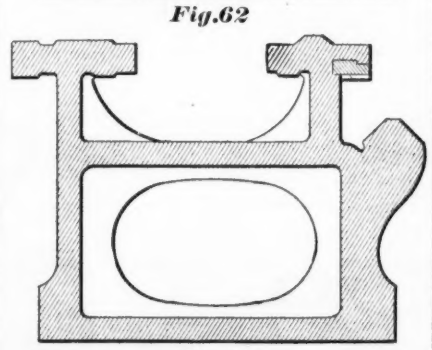


Fig.63

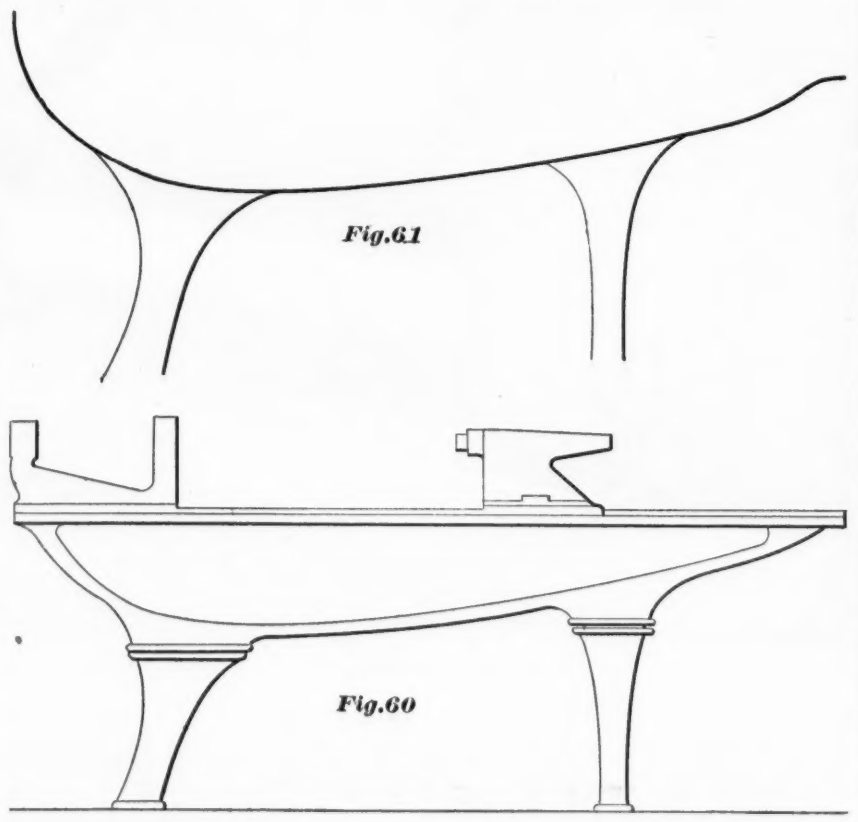


Fig.61

Fig.60

The Care and Management of Lathe Tools.

BY FRANK H. RICHARDS.

I have lately done what I should have done long ago, and what every reader of the AMERICAN MACHINIST should do. I have procured a binder for preserving the paper, and shall find it convenient occasionally to look back over the file and see as a whole what is said by your various correspondents upon each special topic as it comes up.

There has been some discussion of late as to coarse and fine feeds upon the engine lathe. If I were called upon to offer a remark upon the subject, I would say that, if the speed and feed of the machinist's head be properly adjusted there need be little complaint as to the product of the machine he operates. By the way I may note that in our shop this week a pulley 28″ diameter and 10″ crowning face was bored and turned with a single tool, upon a lathe designed for general work, in 4½ hours.

Much is also being said as to the design and construction of the lathe, with some valuable suggestions of improvement. The advantage that can be taken of these suggestions is at the present but limited. A brisk demand for machine tools has brought many new makers into the market, and even if business continues active there remains more than a likelihood that the machine-tool trade will soon be crowded. There is not likely to be nearly as many new lathe patterns made in the next few years as in the few just past, simply because it will not pay, so the chance to work in all these improvements is limited. Still I am far enough from suggesting that it is not true that the survival of the fittest is the law of the life of machine tools as of everything else.

But while the scope of available suggestion as to improvement of the engine lathe is thus narrowed, there is a broad field for the communication of ideas as to cutting tools in use upon our lathes, and I would like to see this field cultivated. Machinists may err in judgment as to their treatment of work and the shape of tools to be used for each special purpose, but more are careless and indifferent about keeping their tools up to their own ideals, and having them always ready for use. The loss of time resulting from using inferior tools and the stoppages for unnecessary tool-dressing make a costly item. It is the exception rather than the rule in a shop, to find a toolboard the tools of which do not invite severe criticism. The devising of means for the abatement of this evil is a topic as broad as the trade, of interest to every workman and proprietor, and as important as any we can touch.

I don't know just where to draw the line between the large shop and the small one, but I will say that certainly when there are a dozen lathes in the shop, and other tools in proportion, every lathe should be numbered, and the tools belonging to it numbered to correspond. To have good tools, and maintain them in good condition, there must be responsibility and a sense of proprietorship. Let each man have his tools capable of indisputable identification, and his right to them guaranteed by adequate authority. Tools cannot be kept in good condition if a general system of borrowing and lending is tolerated. There is no responsibility, no pride, no satisfaction, no justice in the system which allows it. I was once associated in a shop with an inveterate and incorrigible borrower of tools, and I used to compute that, in the way of keeping tools handy and in order for him, two hours per day of his work was done for him by other men, and for which he was unjustly paid. If there is a strict proprietorship of tools, the habits of men as to the care of them may be noted, and their knowledge and judgment regarding them corrected or amended by occasional suggestions. It is annoying to find a man using a tool which is not as good as it might be for his work, and, when you speak to him as to its condition to be met with the excuse that "Bill's been using it, and ground it that way." There is human nature enough in the average machinist to make him very ready with his excuses, and, until they are exhausted, there is little chance that he will learn anything. The young workman especially should, as much as possible, avoid the use of make-shift tools. Let him fix in his mind, as fast as his experience and observation permit, the shape, size, temper and all particulars which best adapt each tool to its special purpose, and, as far as circumstances allow, get them as he wants them, *and keep them up*.

It is a mistaken conception of the possibilities of machine shop practice which leads a man to expect that a lathe tool can be just right only for a few moments at first, say until the first re-grinding, and that it must immediately and continually grow worse and worse until it becomes intolerable, and must then be hurried in despair to the tool dresser to be reshaped and to recommence its hopelessly downward career. It is as a rule, possible—I may say it is as a rule, the practice of the best men—to keep the shape of the cutting point of tool just right as long as it lasts, and when it is all used up it has done a good work, is still respectable in appearance and may be borne to the tool-dresser with affectionate regret, but without shame. Say that a tool needs redressing once a week—and working upon common material, a tool must do a great deal of work to require redressing as often as that—the history of its condition for the week should not be just right for the first day, pretty good for the second, just tolerable for the third and exasperatingly and excruciatingly execrable all the rest of the week.

A carpenter keeps the shape of his chisel unchanged until it is worn out. He does it by continually grinding the bevel face of the chisel parallel with its original surface. The nose of a diamond point is determined essentially by three planes. If the direction of these planes is unchanged, if we grind as much from one part of the surface as from another, it is absolutely certain that the shape of the cutting point is unchanged.

The importance of grinding tools right is worthy of far more thought than is usually bestowed upon it. Whoever has a word to offer in the way of instruction, or who can enforce present knowledge by pungent reiteration, should not restrain his pen. The evil is not merely that the "dumpy" grinder is the fellow who digs the holes in the grindstone, that he wastes time by his frequent stoppages and excursions to the tool-dresser, but that he is *all the time* working with inferior tools, and that the quantity and quality of his product is also, and of necessity, inferior.

It is a common fault among large companies and corporations, neglecting to supply their employes with that class of available information which will enable them to produce superior results in their special lines of manufacture.

A wise course for all railroad companies to follow would be to furnish a copy of the proceedings of the American Railway Master Mechanics' Association to each of the foremen and gang bosses in their repair shops. This would put into the possession of such men a class of valuable information, which would enable them to produce a far better locomotive than they would otherwise do. Furthermore, it would induce them to think and use their reasoning powers in directions which would generally escape their notice.

Shop Kinks.

No. 40.

By LEWIS F. LYNE.

THE TRY SQUARE AND ITS USES.

The two sides of a try square should form an angle of 90°, or the one-fourth part of a circle; but in hundreds of machine shops that exist in our land there are found all sorts of tools resembling try squares in appearance, and so named, which, when the test is applied to them, are found entirely inaccurate. In other words, the angle is found to be, in some instances, more, and in others it is less, than a right angle.

After an apprentice becomes somewhat accustomed to a shop, he tries his hand at making a pair of calipers, working at them during his spare time. Occasionally he becomes so much absorbed in making these tools that he encroaches too much upon the time belonging to his employers, and therefore receives a mild sort of reprimand from the "boss." When he has succeeded in making a satisfactory pair of calipers, he next tries his skill in making a square. The way these tools are generally made is by taking a piece of steel for the beam, planing it up to the right size and squaring up the ends, after which a slot is cut in one end to receive the blade. The blade is neatly fitted and held securely by two or three rivets passing through the end of the beam and blade. It is a very difficult undertaking with ordinary appliances to cut this slot precisely at right angles to the sides and ends of the beam, and, when the blade is finally secured, it will be found that the blade leans to one side or the other, as shown in Fig. 1 of the accompanying sketches, where *A* represents the beam and *B* the blade. *C* is an end view, the dotted lines showing the position of blade, as described.

The best way to make a square without special tools is to make a complete flat try square of the size desired out of thin sheet steel, the thickness depending upon the size of square desired.

In almost every instance where squares are made by amateurs at tool making, the blades are left entirely too thick.

After the square above described has been trued up and finished upon the sides, two pieces of flat steel should be made exactly alike as to size, to be riveted upon the sides of the short arm of the square to form the beam.

To properly locate these pieces, the square should be placed upon a surface plate, and the parts clamped in position, care being taken to get them all to bear equally upon the surface plate, after which holes may be drilled, countersunk, and the rivets inserted. The angle formed by the cutting edges of the drills for countersinking the holes should be about 60°, so that when the rivets are driven, and the sides of the beam finished, there will be no trace left of the rivets, which should always be of steel.

When a square has been thus far completed a search is made about the premises for Smith or Jones, who has the reputation of having the best and truest square in the shop. A loan of the same is solicited to test the accuracy of the square being finished. Repeated attempts enables the young workman to secure a close approximation to the accuracy of the borrowed square, with which he is satisfied for the time being.

When he is required to do an accurate piece of work he finds that in reversing his square the indications do not agree, so he tries to find the difficulty. A close examination reveals the fact that the blade is winding, besides it is slightly inclined to one side. If inclined, as shown at *E*, in Fig. 1, the end of the blade only will touch a square piece of work when the tool is held in a proper position, as shown in Fig. 2, where *I* represents the piece of work, and *F* the square.

It is a custom among machinists to tip the beam as shown at *G'* and *H'*, to enable the workman to see light under the blade. This only aggravates any imperfection in the squareness of the blade, for when the beam is tipped, as shown at *G'*, it will touch the work at *G*, occupying the position indicated by the dotted lines, *G*, *G*, whereas if the beam be tipped, as shown at *H'*, the blade will assume the position indicated by the dottod lines, *H*, *H*. These conditions will exist when the blade of the square is inclined, as shown at *E*, in Fig. 1. If the blade is inclined towards *D*, a precisely similar condition will exist, except in the reverse order.

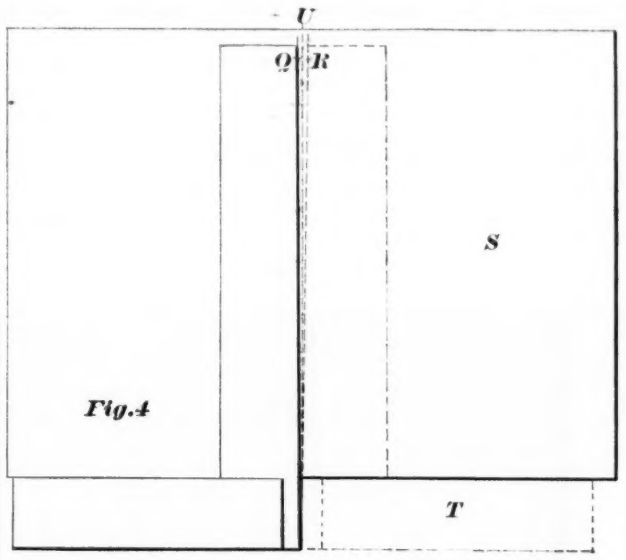


Fig. 4

It is next to an impossibility to perform accurate work, or test the same with a square having a thick edge, because of the reason already stated that the light cannot be seen between the edge of the blade and the work. We therefore conclude that the ordinary steel square, as shown in Fig. 1, is not just the implement required for producing accurate work.

The most ingenious tool that I ever saw for overcoming the foregoing difficulties was a sort of self-proving square, made by a machinist named Charles A. Leib, in New York City. This tool is shown in Fig. 3,

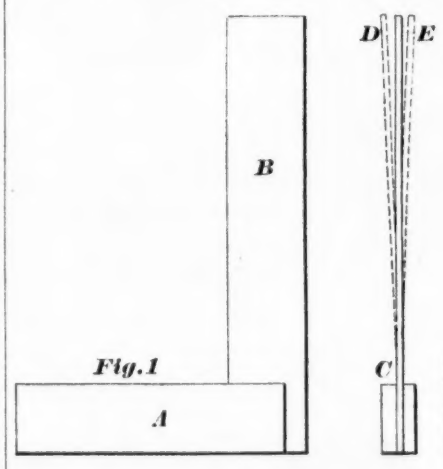


Fig. 1

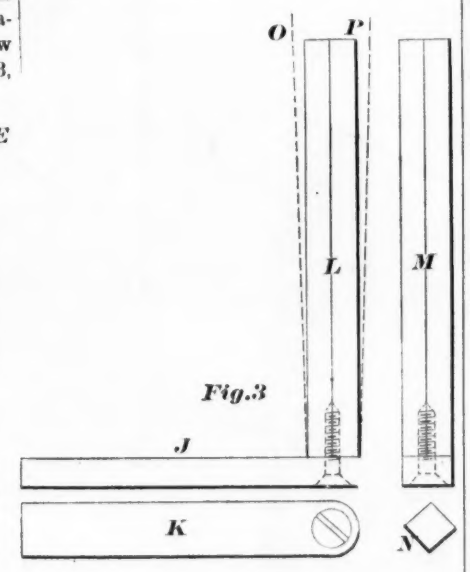


Fig. 3

and consists of a steel beam, *J*, showing a bottom view at *K*. In the end of this beam is a hole for the reception of a screw, with a common beveled head. A square piece of steel, *L*, *M*, forms the blade of this square, *N*, representing the end of the blade. The blade is first planed, then tapped and hardened, after which it is ground to bring the sides exactly parallel and of equal size, which makes the bar perfectly square. The beam is of rectangular section, and with this exception, is hardened and ground in the same manner as the blade. The end for the screw is then carefully ground at right angles to the sides, after which the parts are put together and the screw tightened. If the blade is not precisely at right angles to the beam, it will occupy a position indicated by the dotted line *O*, then, if the screw be loosened and the blade turned half a revolution, the edge will stand as shown by the dotted line at *P*.

The end must be so ground that the blade will occupy precisely the same relation to the beam when turned in all positions. When this is accomplished, we have a square that is a very close approximation to perfection.

We test the accuracy of work with one of the corners, and when it becomes worn, another may be turned into position and worn, and when all are worn the blade is removed and trued up by grinding as at first. In testing the accuracy of the ordinary square, it is usually placed upon a flat surface having a straight edge, as shown in Fig. 4, where *S* represents the surface with the square upon it. The beam is pressed firmly against the edge of the surface and, with a scriber a fine line is drawn along the edge of the blade. The square is then turned to the position *T*, indicated by the dotted lines, and a second line is drawn along the edge of the blade. If the tool is less than a right angle the line with the square in the former position will incline towards *Q*, while in the latter position will appear as shown at *R*, whereas, if the square be correct, the two lines will exactly coincide with each other as shown at *U*.

This is not a reliable test for the accuracy of a square, but it answers very well in case of emergency.

It is difficult to draw the lines to exactly represent the edge of the blade owing to the fact that the slightest inclination of the scriber to either side will make a crooked line. The form of square shown in Fig. 3, always presents a fine edge to work to, and may always be relied upon for accuracy when properly fitted up. This square would seem to be quite as easily made as the common one, but the construction of an accurate try square with the ordinary machine shop appliances, is a job that will test the skill of a good workman. It is not patented, and, so far as I know, all have the right to use it.

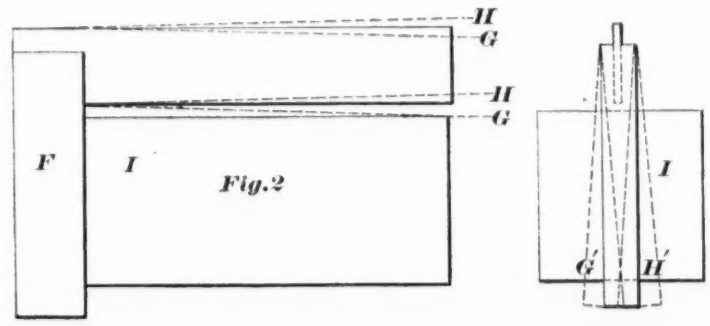


Fig. 2

Cause of the Relation of the Co-efficient of Adhesion to the Length of Belt in Contact with the Pulley.

By WM. B. COOPER.

I submit the following as a simple explanation of a mechanical phenomenon, the cause of which is not at first apparent, and all the explanations of which, in the text-books, are technical, and consequently not popular.

The law governing the friction between surfaces is, that it is directly related to the pressure with which they are brought together, regardless of the *extent of surface in contact*.

If a belt is passed over a fixed pulley, and attached to a weight, it is well known that the power necessary to raise the weight by drawing upon the other end will increase, if the portion of the belt in contact with the pulley is increased, and to such an extent that if several turns are made around the pulley the power required bears no comparison to the weight raised, so great has the friction become.

To explain this, let us imagine the portion in contact with the pulley to be divided into a number of sections. Now, when sufficient power is applied to raise the weight, it is clear that, commencing at the weight end, the first section requires to move it a force equal to the weight, plus the friction between itself and the pulley. The second section will have a larger coefficient of friction, on account of its being brought into closer contact with the pulley. This results from the fact that the resistance to be overcome is the weight, plus the friction of the first section.

Thus it is manifest that the last section has to overcome the weight plus the sum of these increasing coefficients of all other sections.

This explains the ability to transmit so much power by a belt coming in contact with only half of the periphery of a pulley.

This phenomenon is made possible by the convexity of one of the surfaces, and the flexibility of the other. A number of shoes would operate in the same way as the belt.

Where the surfaces are of such a character that the friction is at a maximum at a certain pressure, it is clear that where that pressure is exceeded, the width becomes an important factor, as it alters the pressure per inch between the surfaces, in other cases it is immaterial.

The Industrial Monitor in its first issue closes an article on business ethics as follows:

"It is an easy thing to say 'let every man look out for himself,' but after all the whole business of life is for other's good, or it is a poor business. The man who covers a heavy scrap of pasteboard by a thin piece of leather, and hides it from view on the sole of a shoe, is no better than the dairyman who draws largely on his pump for his stock in trade. One should be just as liable to prosecution as the other. It does not relieve the act of its fraudulent character to say that the public cannot expect a full leather shoe for a pasteboard price. The customer does not ask for a pasteboard shoe, and would not buy one if he knew it. He cannot cut into it to learn whether it is leather or paper. He must find out when it is too late to help himself.

"In all business transactions, in art, science and philosophy, 'honesty is the best policy.' In a proper regard for the rights of others lies the greatest good, the surest prosperity, perpetual peace and the stability of free government."

A railroad bill introduced in the Nebraska Senate fixes the passenger fare at three cents, and on roads running accommodation trains at two cents per mile. On freight, for car-loads of 24,000 pounds or less, consisting of wheat, rye, oats, corn, barley, flax, broom-corn, potatoes, turnips, or other grain, for the first thirty miles or less never to exceed $10, and for each additional fifty miles or proportion thereof not to exceed $3.

Perfection in Moulding.

BY THOMAS D. WEST.

Perfection in moulding can only be reached through rigid attention to trifles. There is nothing grand, or, mechanically speaking, great, about making a mould. Close attention to small things, a little delicate hand work here and there, with the exercise of good judgment, is all there is of it. If the end is successfully reached, it demonstrates that the necessary skill, judgment and care controlled the manipulations. Whenever the result is bad, the intelligent moulder can generally trace it to some trifle neglected. Trifles neglected leave chances to be taken, which is where luck comes in. Trusting to luck is like a lottery: you may win, but the chances are you will lose.

There are more castings lost through the neglect of trifles than through ignorance, or the want of judgment. A large number of moulders of all classes take chances, and when they succeed it can be said that it is more good luck than good management. It is not always the poor mechanic that loses the most castings. There can be found plenty of first-class mechanics, having a large experience, who cannot be called reliable moulders. Their castings are lost through simple negligence, or in their being too willing to take chances. A careful moulder will always give a doubt the preference. If he is not sure, or feels that anything is not safe, he will, if possible, secure it beyond question.

In moulding there are possibilities of bad results that one thoughtful moulder may not foresee, which another one would. Some moulders have to thank experience dearly bought for all their good results, while with others experience has but little to do with results. A good, careful judgment is the secret of their success.

There may be said to be two classes of trifles—the known and the unknown. When a casting is lost through the latter, we can often charge it to ignorance, or the want of judgment; when through the former, to negligence.

Whenever there is a new engine or machine to be built, the designers and builders make it as perfect as their experience and judgment teaches them. They will give great attention to the details, and when completed the machine is given a trial. The first machine is seldom entirely a success. There are generally some little trifling things to be afterwards altered to make it perfect. The designer or builder would not like to be told that he was ignorant, or had no mechanical ability, as a reason for the first engine or machine being imperfect. In the building of new machinery there is generally allowance made for the improvement of trifles. As the builder or designer requires trials of new work before it can be made perfect, so does the foundry manager and moulder require the same.

Progress in foundry practice is being made every day, and the uncertainties lessened. Specialties in foundry practice are having an influence in bringing about better work. The advantages of these are numerous. In such shops the moulder generally makes the same job over and over, and he must be a poor mechanic that cannot improve or perfect a single job, in time.

Ten years ago almost, every machinery foundry had a good deal of jobbing. To-day many of these shops discourage jobbing, and have adopted some special class of work, for the reason that they generally find more money in the manufacture of specialties than in jobbing. As a rule, foundries can double their product by having a specialty instead of jobbing, and with less requirement of skill and experience. In jobbing, the first trial must be successful to make things pay; while with specialties, if there is a miss, there is a chance to remedy the loss in others that follow.

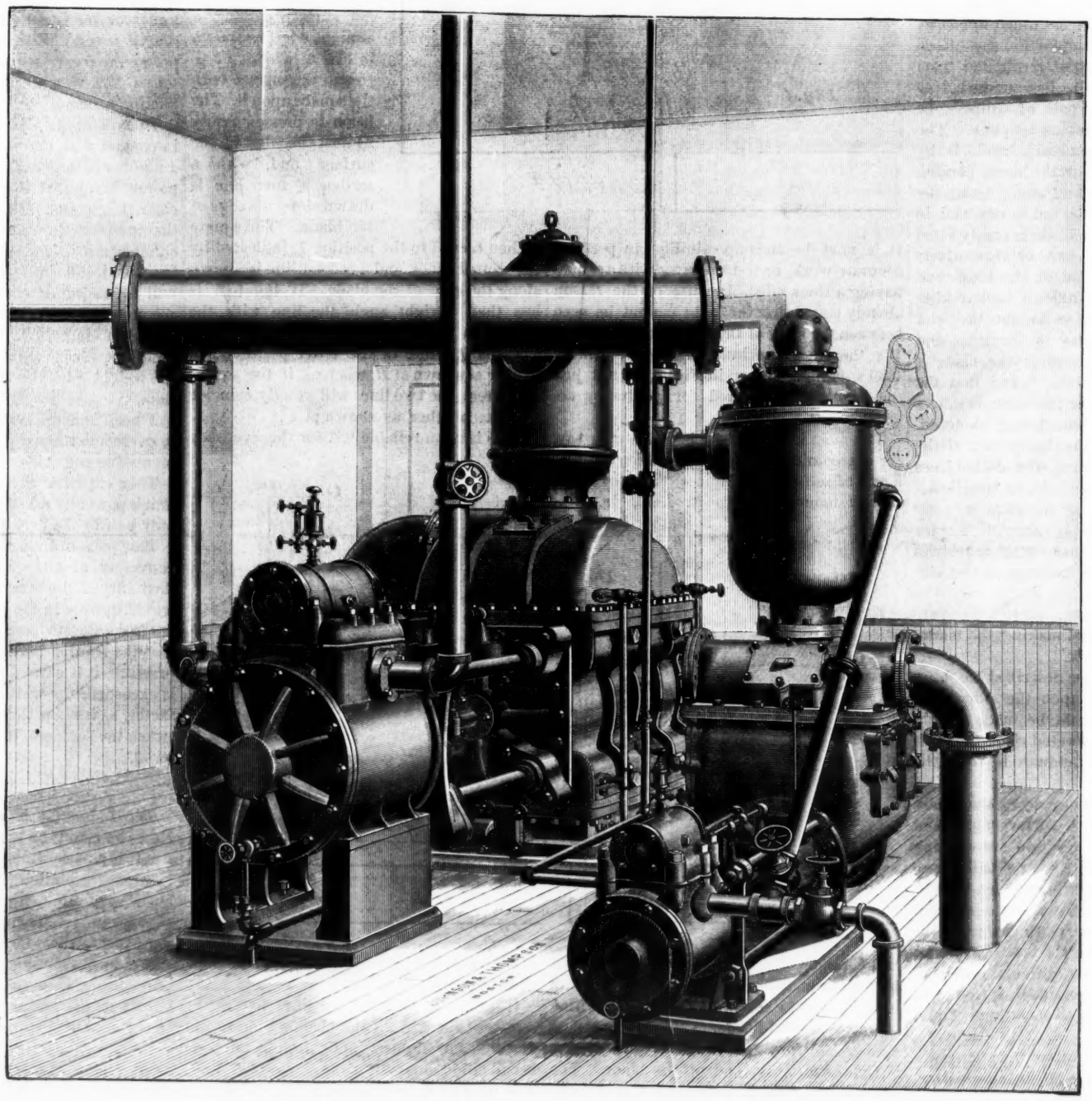
It is not always the moulder that is to blame for his bad results. It may be the foreman's or proprietor's mismanagement, and the manner in which they control their men. Wherever you find a shop in which the men are not under good management and control, there you will find the largest percentage of bad work. A man to be foreman of a foundry should not only be practical, but also have the best of judgment. He should be able to know what skill and experience any job will require; also the time it should be made in, and the qualification of all his men. A foreman is very often to blame for the bad results, in not knowing the requirements of a job, and in giving it to a man that is not qualified. There are hardly two foundries managed alike. One is run so that men are obliged to take chances; another is run leaving everything optional with the men, while in another no chances are allowed to be taken. To discuss the reason for this dissimilarity would be out of place. Suffice it to say that the class of work done may be the cause, but as a general thing it is the management that is responsible.

The best managed and controlled foundries are generally the ones that manufacture specialties. If foundries keep on dropping out of jobbing and taking up specialities, as they now are doing, moulding must be advanced, as the percentage of bad results will be less, and a better quality of castings made.

Another thing that is helping to advance the moulder's trade is the interest which is being taken in foundry literature. By this means moulders can intelligently discuss others' ideas of the science of the moulder's art, and thereby be better able to arrive at correct conclusions.

The present demand of foundrymen is for more first-class workmen. The foremen are themselves greatly to blame for their scarcity. To have good workmen, there must be good intelligent instructors and trainers. The great trouble with foremen is they do not want to be bothered.

There are apprentices and moulders having the ability, that wish to be advanced, and with proper discipline they will make good workmen and be a help in getting rid of the uncertainty that is attached to the present making of good castings.



DEANE'S HIGH-PRESSURE STEAM PUMPING ENGINE, WITH CONDENSER.

Deane's New Pumping Engines.

We illustrate by aid of the two large accompanying engravings an improved system of pumps for supplying cities with water.

The engraving on page 4 represents a simple high-pressure steam pump, with a separate condensing apparatus, as made by the Deane Steam Pump Company, Holyoke, Mass.

The steam ends of both pumps are of the regular style used upon the Deane steam pump. The water end, or main pump, is of the inside plunger type, provided with numerous small valves, having an aggregate area exceeding that of the plunger.

The diameter of the steam cylinder is 24″; water cylinder, 20″, with a stroke of 24″. Exhaust steam passes from the steam cylinder into the heater, thence to the condenser. The heater is the large cast-iron tube shown in a horizontal position over the main pump.

By this arrangement the available part of the heat contained in the exhaust steam is utilized in heating the feed water.

Feed water is raised by a pump (not here shown) from a hot well at a temperature of 100° to 110° Fahrenheit, and passes through the heater, leaving the same through the two pipes shown at the left-hand end of the heater.

This pumping engine is one of a pair which were calculated, when working together, to deliver 4,000,000 gallons of water every twenty-four hours, at a pressure of 100 pounds per square inch.

This engine has been in successful use for about two years past, and comprises an efficient part of a large city waterworks.

The engraving here shown was made from a photograph before the lagging was applied. The other engraving, on page 5, represents a compound, condensing, duplex pumping engine, before the lagging was applied. The capacity of this engine is to deliver 2,500,000 gallons every twenty-four hours, against a pressure of 100 pounds per square inch, the piston speed being about 90 feet per minute. It will be observed that the high-pressure steam cylinders are placed between the low-pressure cylinders and the pumps.

The dimensions are as follows: High-pressure cylinders, 16″ diameter; low pressure, 30″ diameter. The condensing apparatus used with this engine is of the same style as that used with the engine previously described, and is located below the floor, the condenser being just visible above the floor. The valve motion upon the steam cylinders is a modification of the Worthington duplex valve gear. The pump is an inside plunger of the multi-valvular construction. The steam cylinders and cylinder heads are steam jacketed with live steam, and the outside is covered with a jacket of asbestos. The advantages of a compound pumping engine of

this class are well understood. The machinery is not complicated, and any man of ordinary intelligence can operate either of these pumping engines.

LETTERS FROM PRACTICAL MEN.

Notes on Planers and Lathes.

Editor American Machinist:

The remarks recently made in your paper in regard to planer graduations have been read by me with great interest. A number of years ago I had a slotting machine to repair. I had a set of gibs for this machine which I gave to a shaper hand, telling him to make the angles 60°, the same as the bar had been planed. I came around shortly after and saw that the man had the head set to the wrong angle. It then occurred to me that the bar had been planed on a knee plate, which made the difference, and I soon had the head set right.

This reminds me of a bricklayer who had an angle plumb made to use in building a taper stack; the carpenter made the large end of the plumb at the bottom instead of at the top. Strange to say, he had run the chimney ten or twelve feet before discovering that he was making a chimney with a big head.

I have been interested in your remarks on lathe spindles and beds. I believe the chief difficulty has been in making the ways too small and too sharp. I am building a lathe 18" swing, with 1½" ways, of 120°. I think the ways should be on each side, particularly for the head and tail stocks, as with one V and one square side the wear would be unqual, and the head would not be set right at different places, if worn as it would be, unequally.

I had a 5-foot fly-wheel, 800 lbs., to bore out, and used two spiders and a bar which I keep for such purposes; time to run cut through, fifteen minutes; though it took some little time to get the wheel trued up, and was hard pulling on heavy cuts, it was as good a job when done as if done on the most expensive lathe. BALANCED VALVE.

Distinguishing Steel from Iron.

Editor American Machinist:

Your correspondent "K.," in your issue of February 3, calls for "an infallible rule for determining whether any piece of metal be iron or steel," and goes on to say that "to prevent any discussion of the ancient query, 'What is steel?' I will define it to be any product of the crucible, open hearth, or Bessemer process, and iron to be a product of a welding process." Now, if "K.'s" definition be accepted as correct, there is certainly no way for him but to go to the works, and ascertain whether the piece of metal was made by a welding or by a melting process, as products of either can be brought out, which no man can distinguish, one from the other, either by chemical or mechanical tests; and those thin sheets, such as he describes, are a notable illustration. There is a company near Boston which makes such metal by both processes.

A definition of a very simple word is sometimes very complicated; as for instance the definition in Johnson's dictionary: "*Net-work.* Anything reticulated or decussated with interstices between the intersections." The ponderous doctor evidently "wrestled" with that word a long time, till finally fearing it would get the better of him, came down upon it with his whole force and fixed it for all time. But the definition given by K. is not fixed for all time, although something like it was supported by Mr. Holley.

A suit has lately passed through the United States Court, involving many thousands of dollars of duties, paid under protest, by importers of certain ingots and blooms, classed by the Treasury department as steel, because they were the product of one of the new processes, but after a long trial the learned court decided that the metal in question was iron, ingot iron.

Braintree, Mass. WM. H. HARRISON.

The Whys and Wherefores of Shop Work.

Editor of American Machinist:

Some of the little things which enter into the every day practice of machinists are treated so differently by different men as to cause great surprise in the mind of the thinking observer, leading him to ask why two men who work side by side in the same room, at the same kind of work, should adopt methods in attempting to arrive at the same results, by no means alike, and often as exactly opposite in character as ingenuity could well devise?

If it be a fact that all learn from others what they know of machine building, as some assume, why should not two men who work in the same shop where they learned their trades—who have never worked at machine building in any other shop—learn to do the same things in the same way? Why does one man always adopt the correct method and always turn out good work, while the other man, who might at least learn from his more skillful shopmate, persists in doing the same things in a way which produces inferior work and can produce no other? Or if it is not true that all learn simply what they are taught, but on the other hand is a fact that some learn to think (rather than learn to do things in some specific way) thereby becoming fertile in expedients, and always ready, no matter what difficult job presents itself, to at once think of a right method for doing it, why should there not be more such mechanics? The demand is for more men who work by methods which they know by reasoning must be correct without putting them to an experimental test, and who are confident when they complete a job that it is right, because having been done properly, by a correct method, it could not be wrong.

Take as an illustration the difference between two men in securing a piece of work for planing to some given size, and which needs to have sides and edges exactly at right angles. Here is the way not to do it: The piece is clamped in position without first measuring to see how much is to be taken off; a tap with the hammer shows it is not down, and with some vigorous blows he tries to drive it down. After hammering till he is red in the face without getting the piece down, and without thinking why it connot get down, or how much damage these continued whangings must be to the planer, our man proceeds to take off a good cut. Then he complacently turns it over for a repetition of the whanging with the same result—but why follow him further? The pieces planed by him are never square. He intends to leave enough to take off with the file so that they can be squared up, but he will often be found telling the foreman that "this piece would not clean up; took just as light a cut as I could first time, and when I turned it over found it wouldn't clean."

Here is the way to do it: First the piece is measured to see if the right amount of stock is there. If at any point the piece is scant, a plan is devised whereby the surface can be removed from the first side and barely clean the scant place. Should the tap of the hammer show you the piece is not down, there will be no whanging. The man doing the job properly, knowing that there is a reason for it when a piece comes down at one side and not at the other, will relieve the clamping device, and with a little packing of tin or sheet iron, or paper (perhaps the thinnest of tissue paper which he has carefully stowed away in his pocket), put where it will do the most good, he again clamps the piece, and taps it gently. It seems a part of the planer, no noise, no fuss, no bruising of work, nor planing of planer-table or chuck, but quietly and surely each piece that this thinking man secures for planing is brought to a bearing, which makes good work a certainty.

Why cannot the other man learn to think that the bearing which a piece takes on a planer, is governed by the bearing against which it is clamped, and that hammering a piece down, or springing it down with clamps from above, against the natural position which it takes either on account of its own shape, or the side bearings against which it is clamped, can only result in producing bad work?

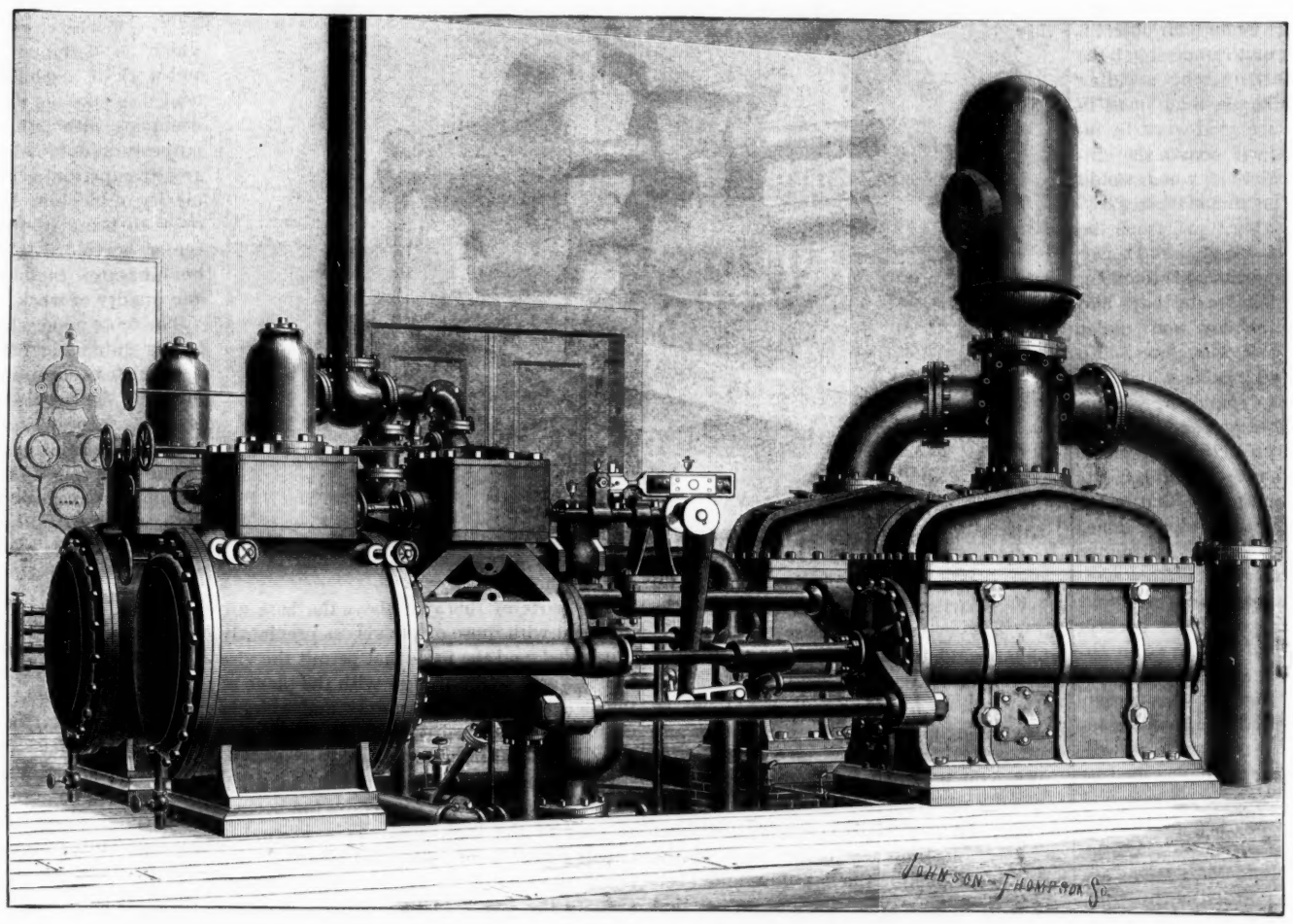
Put the same two men on lathe work. If one has a taper to turn he will either measure the length of the piece to be turned and calculate the necessary amount of set off to produce the taper, or turning a short place at the end of the piece a little larger than that part is to be finished, he will at another point in the length of the piece turn another short place just as much above the finished size called for at that point; then setting the dead spindle over so that a tool set in the same position will touch both points alike, he has nothing to do but to boldly start the tool and let it run up. The other man guesses the spindle wants setting over some uncertain, indefinite amount, and feeling his way along, for fear he shall get too deep, he turns off chip after chip, changing the position of the back spindle a little each time, until he guesses it is near enough to file to it; then he files it. He never turned a taper to fit in his life except by accident, and the other man—why, he had his taper turned to a perfect fit before this unthinking, hard-working fellow had got half through turning, let alone the filing.

Give the same men some pieces of steel to clamp to the face plate of the lathe, and through which holes are to be made and turned out to an accurate size—smooth, true and straight. The men who don't think (or, rather, don't think rightly) will use a blunt scraping tool, set above the center, which does not cut at all; but, by dint of catching and snapping, so that it may be heard all over the shop, the metal is torn and bruised off. A hole is made, which is neither round, straight, smooth, nor concentric with the axis on which the piece revolved while the hole was being turned.

The man who thinks will take the same tool, grind it so that it shall have a good shearing cut, set it below the center, and, with the only sound from it a satisfied purr, this tool that had to be ground half a dozen times to bruise out one mean hole in the first man's hands, will turn out without regrinding half a dozen holes—smooth, straight and round—all that could be asked for.

Give these two men each a pinch bar to move some heavy weight along the floor, and the man who thinks will, with a short bite, do some good every time he puts forth his strength, and do it easily, while the other man will run his bar away under the piece to be moved, and lifting until his back snaps and he sees stars, will possibly lift one side of the piece he is trying to move, only to see it drop back again in the same place.

It is probable that the reader who has had patience to follow thus far is beginning to ask, What of it? Simply this: In the way in which a machinist does these little things, there is to be found a true index to his character as a machinist, and through it to the character of his work. For all



DEANE'S COMPOUND DUPLEX STEAM PUMPING ENGINE.

things there must be a cause; and, while boys should learn trades, and should learn to do things in specific ways, because they are told that those ways have been tried and are known to be right, they should, at the same time, be taught *why* the methods which they are told to adopt are the best. They should learn to reason from cause to effect and *vice versa;* should learn why a tool for cutting metal will, when properly hardened, ground and set, stand to cut for hours, leaving a clean, smooth surface, while another tool needs grinding twice an hour and does no decent work; why the man who, having a number of pieces of light work to plane up as nearly alike as possible, provides himself with templates by which to set his tools, and, leaving a tool set in the same position, takes a cut just alike from all the pieces, or two cuts from each piece if they are to be square. They should understand why this man does more work and better work than the man who sets his tools by measurement or guess, and persists in going all over one piece before commencing another.

In short, those acquiring a trade should learn to either find good reasons of their own why all methods coming under their observation are good or bad, or to understand the reasons given by others, thereby avoiding the waste of much valuable time spent in vain endeavors to produce good work by incorrect methods. This will save to the customer much money and time, which would otherwise be spent in "making machines go," which should, and might, "go" from the start.

Employers, superintendents and foremen, can well afford to explain to the boys and young men in their employ and under their charge the whys and wherefores. No investment in time and trouble will bring more sure returns to the employer, pecuniarily, and to the superintendent and foreman, in the greater ease with which thinking, close-reasoning men can be managed, and the satisfaction growing out of the fact that under their supervision good work is being done, bringing with it reputation to be most highly prized for all concerned.

"Yes, I see it now, but nobody ever told me before." This from a young man twenty-five years of age, who had served as an apprentice five years, and worked in a good shop as a jour. machinist for four years, when, after having spoiled a job and commenced with new stock to replace it, he was told by his new employer that the method he adopted would as inevitably spoil the second job as it had the first, and given the reasons why. "I see it all now," said the willing, well meaning blunderer. "Nobody ever explained anything to me in this way, but I was just told to do a thing so and so, and scolded if I did it any other way, but with no reasons given except that I must do what I was told, I am very much obliged for what you have shown me. Sorry to have troubled you with my blunders, and hope that you will set me right in future, for I am anxious to learn." Let's give the boys a chance. S. W. GOODYEAR.

Waterbury, Conn.

The Engine Lathe.

Editor American Machinist:

Notwithstanding the many advocates among your correspondents, of the flat, dove-tailed lathe beds, there seems to be no proof of their superiority, further than that they are made in that way in England, and by one or two first-class tool builders in this country. It cannot be disputed that lathes made in that way are doing good work all over the world, but anyone who has had experience with such a lathe, or any other tool with a saddle sliding upon a dove-tailed way, knows that it will wear loose where it is used most, and then cannot be worked full length with the gibs snugly set up. Unless the gibs are tight, the saddle will give a worming motion to the cutting tool, and produce bad work.

Such is not the case with a lathe saddle sliding upon two V's. This will carry a steady cut without being gibbed, and the wear of the ways affects the accuracy of the work less than with the dove-tailed flat ways, because the wear is vertical, while with the flat ways it is lateral, or from the gibs. The most perfect lathe imaginable would be a good heavy planer with all but the bed and table taken away, and a pair of heads fastened to the bed; that is, it would do the most perfect work.

A lathe should be built upon the planer principle. A long carriage moving upon V's of sufficient size to prevent abrasion, and of the angle that would be best for a planer.

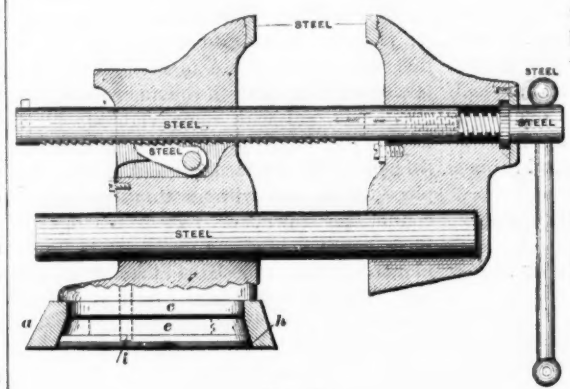


FIG. 2.

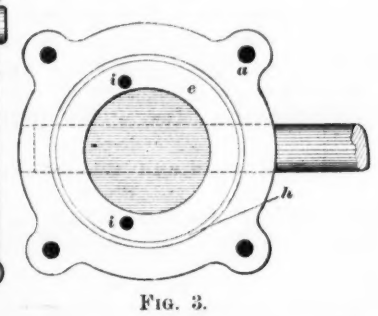


FIG. 3.

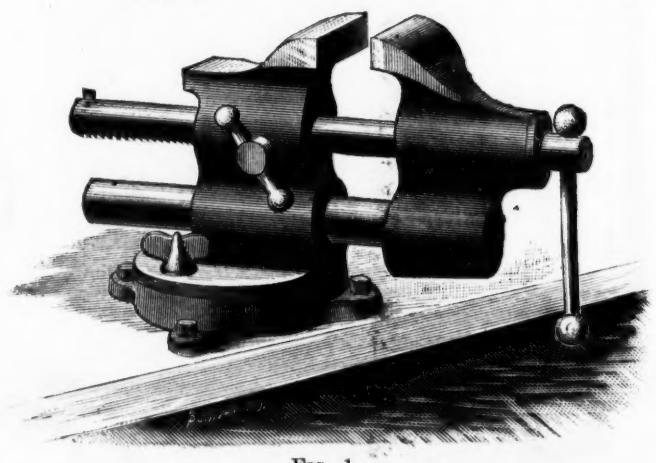


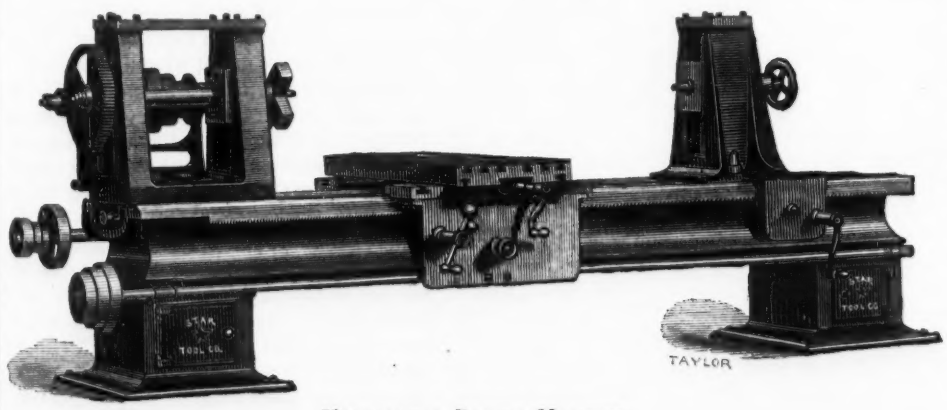
FIG. 1.

Gibs would be necessary, of course, as it would not be desirable to have the carriage as heavy as a planer table, but they would not necessarily come in contact unless the cut was heavy enough to raise the carriage, which would occur only when taking a roughing cut.

The last, or finishing cut should not be heavy enough to raise the carriage of any well-proportioned lathe.

When the V's have worn enough to produce bad work, they may be straightened by replaning, at a very small expense, and without seriously affecting any other parts of the lathe; but replaning the flat, dove-tailed bed will narrow the ways to such an extent that a new gib must be made, and the whole work of fitting and scraping would be necessary, the same as when the lathe was built.

The Yankee who made the lathe with tilting carriage, held down with a weight, knew what he was about.



HORIZONTAL BORING MACHINE.

There has never been so satisfactory a lathe built for small work. The quick tool adjustment, and the weight to keep all parts of the carriage down snug to the ways, fill all the requirements. For larger lathes the gibbed carriage, with T slots for bolting on work for boring, is better. The carriage should be long and heavy.

There are a number of points about the engine lathe that might be discussed profitably, but the form of bed and saddle seems to be the question under discussion at present. G. A. GRAY, JR.

Cincinnati, Ohio.

Quick Adjusting Swivel Vise.

In our issue of October 8, 1882, we illustrated a new parallel vise, the invention of John Thomson, of No. 9 Spruce street, New York City. We present with this a journal swivel vise just brought out by Mr. Thomson, which is shown in perspective in Fig. 1, in sectional elevation in Fig. 2, while Fig. 3 represents a detached bottom plan of the base.

The parts of this vise above the base are identical with those of the vise as previously illustrated, and the parts that permit the vise to be swiveled at any angle with the plane of the bench, and to be securely and quickly clamped in the desired position, are designated by literal references.

In explanation of these parts: a journal, *c*, of large dimensions, is formed on the bottom or base of the back jaw. This journal is closely fitted to the parallel part of the internal diameter of the base *a*, which is fastened to the bench in the ordinary manner. The lower part of the internal diameter of the base is tapered, as shown in Figs. 2 and 3, at *b*. To this tapered part is fitted a correspondingly tapered disc or ring, *e*. Two clamping screws, *i*, with heads seating upon the upper surface of the base of the back jaw pass freely through the base and engage the disc *e* by means of screwed ends. When these clamping screws are loosened, the vise is free to be turned in either direction, being guided by the parallel circular surfaces, as clearly indicated. To make the vise permanent in any position, it is only necessary to tighten one or both of the clamping screws (according as it is desired to hold the vise moderately or very rigidly), the operation of tightening the screws bringing the tapering surfaces of the disc and the base into close contact, thereby locking the base to the upper part of the vise.

In this vise it will be seen that all manipulations required in adjusting to different angles are performed above the bench, and very quickly. All deflective strains are resisted by the ample journal bearing, the whole diameter of which is effective for this purpose. This latter feature entirely relieves the clamping mechanism of any duty except that of preventing rotation, thus insuring durability and correct action in this important detail.

Other and general features of this vise were explained in the previous illustration, to which reference may be made, or they may be readily comprehended from a study of the present engravings.

New Horizontal Boring Machine.

The accompanying engraving represents a horizontal boring machine recently completed, which is designed for boring cylinders and work of a similar character. It is intended to take the place of a lathe, which is inadquate, although commonly used for the purpose, and to which it is claimed to be greatly superior, as all the trouble and perplexity of blocking the work upon the carriage to bring it properly in line with the center, is avoided Not only is time saved, but far better results are obtained in quantity and quality of work.

The table upon which the work is placed has an automatic feed. The boring bar is brought to the required position by raising or lowering the centers of the machine, which is done accurately and simultaneously by means of suitable gearing and screws.

The head spindle has large, long bearings, running in composition boxes, and at its highest point will swing 46″ over the bed and 33″ over the table. It is driven by a cone with four sections, for a 3″ belt, and in connection with the back gearing, has a range of speeds adapting it to turning or boring from ¾ of an inch to 33″ diameter. The housings for the head and foot spindles are quite substantial, and are mounted on a heavy, strong bed, supported by cupboard legs. A large face plate and a suitable tool rest are furnished when required, so that the machine can be used for turning, also for a number of purposes other than for which it is especially designed to, good advantage.

It is made by the Star Tool Co., Providence, R. I.

The recent experiments with the spring street car motors in Philadelphia are said to have proved that it is possible to propel cars smoothly and rapidly by the expansion of powerful steel springs, the difficulty of giving a uniform and perfect temper to the metal having been overcome. The company controlling the patents makes the following claims: The motor consists of six springs coiled upon a cylinder. Each spring will be made of a flat bar of steel 300 feet long, 6 inches wide, and one-fourth inch thick. These springs are tempered by the new process so uniformly and delicately that their power is said to be increased. After first being coiled so that their diameter is 18 feet, they are tempered, and then wound up until the diameter is 7½ feet. In this condition they are placed upon the motor truck and the appliance of the patents adjusted.

Nearly 1,000 of the mill operatives of Lawrence, Mass., held a meeting on the evening of Jan. 20, to consider the best means of securing a law compelling weekly or semi-monthly payments by corporations. Sympathy with the movement was expressed by the mayor and several of the prominent members of the city government. A resolution to petition the legislature was adopted.

Testing Machines for Governmental Ownership.

Our readers are already somewhat familiar with the advantages of the Emery testing machine in the Government Arsenal at Watertown, Mass. It has demonstrated that a large part of the supposed knowledge heretofore accepted as reliable, upon the strength of constructive material, is fallacious. In order to make proper tests to give reliable data it is desirable to construct two more machines, as the present machine is limited in its operations. The designer and builder, A. H. Emery, has written a letter to the Secretary of the Navy upon the subject, the greater portion of which we produce on this page. The machines ought to be constructed, as Mr. Emery has pointed out, for the benefit of the whole people as well as for the Navy.

RIGGS HOUSE, WASHINGTON, D.C.
January 13, 1883.

Hon. Wm. E. Chandler, Secretary of Navy.

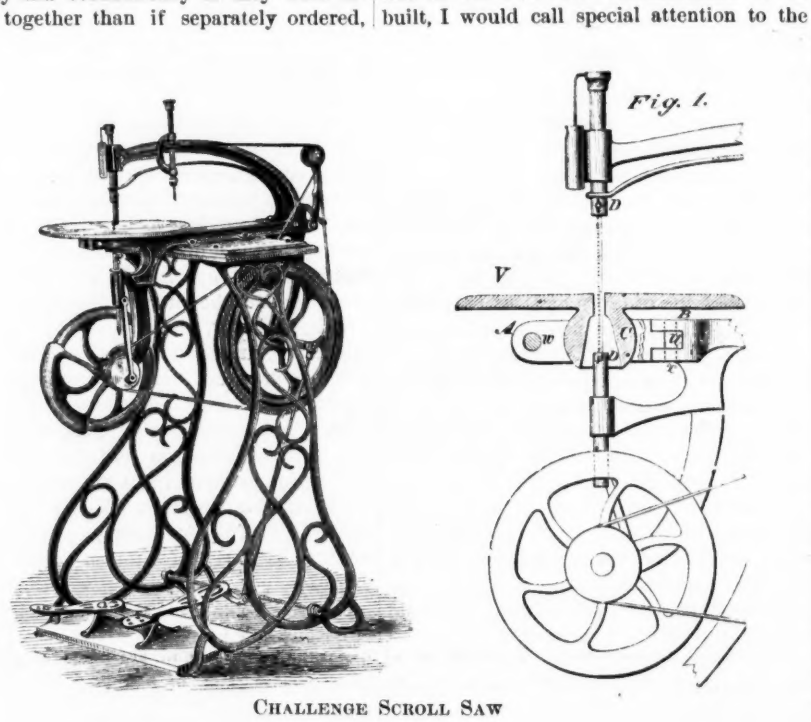
—SIR: On page 149 of the book of estimates for the fiscal year ending June 30, 1884, appears the following:

"Testing Machine, Watertown Arsenal—Caring for, preserving, using and operating the U. S. testing machine at Watertown Arsenal	$10,000
Purchase of material for specimens and labor to prepare them.....	13,500
For a machine for testing the torsional resistance of materials.....	50,000
For a machine for testing the transverse resistance of materials..	50,000
Total.....	$123,500
Reduction by the Secretary of War.	50,000
	$73,500

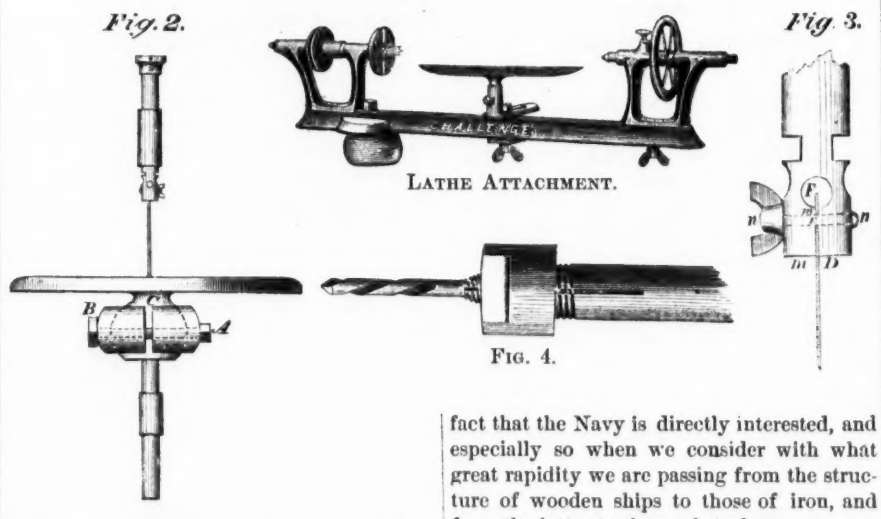
"*Note.*—The present machine is limited in its operations to tests of tension and compression. It is not adapted to make tests of torsional and transverse resistance, which tests are deemed to be of the greatest value and importance by distinguished civil engineers, as well as by this department. Past experience clearly shows that the machine, as it is, is fully occupied, and that, to meet the requirements of the present and future, new machines for this work ought to be at once provided. The results obtained are for the benefit of the whole country. Such machines are too costly for individual enterprise to provide, and Governmental ownership and supervision stamp the published results as so correct and reliable as to make them acceptable to engineers and manufacturers the world over."

In addressing you on this subject I would say, briefly, that the general advantages of the use of the machine at Watertown Arsenal to the interests of commerce and science, and to constructors and users of steamships, railroads, locomotives, engines, machines, boilers, bridges and other structures of metal and wood, is so great and has been so generally and specfically set forth by the various engineering societies and scientfic journals of the country during the past three years, that it hardly seems necessary to call your attention to the great use which science and the arts and manufactures now have for the information which can be obtained by the use of the machine already built, those asked for, and kindred machines; but I may be permitted to say that so fully is this recognized that the Massachusetts Charitable Mechanics' Association, at their exhibition in 1881, at which they awarded over 600 gold, silver and bronze medals to exhibitors from various parts of the United States, provided a grand medal of honor, at an expenditure of some $500, which was awarded to me through the American Academy of Arts and Sciences for this testing machine as the single exhibit most conducive to human welfare. From their report of four pages I quote as follows: "By its use every part may be made safe, from the simple rail to the most complete bridge, from the humble hand-car to the largest locomotive, and from the plain column to the most elaborate trussed roof. A machine which can guarantee the safety of most of our artificial surroundings may properly be called conducive to human welfare."

I called upon the Secretary of War and learned that the reduction of $50,000 was made by him for the purpose of making a general reduction of the estimates for his department, he supposing that $50,000 might be appropriated either for the commencement of the two machines estimated for, or for the completion of one of them, and the other might be purchased next year, should a like amount be appropriated. I informed him that were the money now appropriated for the two machines for testing the torsional resistance and transverse resistance of materials, neither could be had this year; that the money would not be available until July 1, after which the machines must be designed with great care, and subsequently special tools designed and built to be used in their construction, for which reasons at least two years must elapse before the drawings, special tools, and, lastly, the machines themselves, will be completed. I also stated that the two machines would be produced more quickly and economically if they were ordered together than if separately ordered,



CHALLENGE SCROLL SAW



LATHE ATTACHMENT.

FIG. 4.

and I now add that this is the more desirable, as some parts of the work which would have to be provided for either machine can be used for both if they are made and used together, as desired. The Secretary suggested that as the use of these machines was of interest to the Navy Department especially, as well as the whole country, I consult with you in regard to the advisability of your joining with him, or with him and the President, in recommending Congress to make an appropriation of money for the construction of the two machines, one for transverse tests and the other for torsional tests.

So much interest is taken in this matter that the three societies of engineers—the American Institute of Mining Engineers, the American Society of Civil Engineers, and the American Society of Mechanical Engineers—each had a day set apart at their annual meetings during the past year for the discussion of the merit, value and use of this machine. One of the many papers read on these occasions was one prepared by E. D. Leavitt, a member of each of the three societies mentioned, and now president of the latter. This paper was read by him at the annual meeting of the Society of Mining Engineers, held in Washington last February. In it he states that he has had some 240 tests made on this machine, for work of which he had charge for other parties, besides about 100 specimens for himself, and that during the two years in which he had watched the working of this machine he had learned more of the properties of materials than he had before in the whole 25 years of his engineering experience. Certainly a machine which can in two years double the knowledge of our best engineers, as regards the value and properties of structural materials, tends very rapidly and greatly to improve and cheapen and make more safe all our engineering structures, and thus tends greatly to the welfare of the whole people.

* * * * * * *

In regard to the uses of the machine built, and of the two now recommended to be built, I would call special attention to the fact that the Navy is directly interested, and especially so when we consider with what great rapidity we are passing from the structure of wooden ships to those of iron, and from the latter to those of steel.

For these reasons I may be allowed to ask you to join with the Secretary of War and the President in recommending Congress to provide at once means for building these machines. So many millions are to be expended annually in the various structures under Government, including its navy, ordnance, and public buildings, and in the various uses for which the whole country constantly needs an accurate knowledge of the properties of materials, that the amount now asked for seems almost as nothing, and, when the machines are used, will annually be saved to the Government and country, each, many times over, and the same would be the case even though the sum asked for were $2,000,000 instead of $100,000. With great respect, I have the honor to be,

Your obedient servant,
A. H. EMERY.

The Wisconsin Legislature has passed a bill which provides that all goods manufactured by convict labor shall be distinctly marked as such before being put upon the market.

The Challenge Scroll Saw.

We present on this page an engraving of the Challenge scroll saw, made by the Seneca Manufacturing Co., Seneca Falls, N.Y., also sectional views of same and a view of a lathe attachment. Within a few years the demand for scroll saws has developed at a wonderful rate, and a few manufacturers have essayed to place some mechanical refinements upon their particular patterns. One of the features of this machine is a tilting table with hollow ball joints, through which the saw passes, and which can be changed or tilted to any position for sawing inlaid work.

Another feature is an efficient saw-clamp that will hold firmly any width of saw from the finest to ⅛ of an inch, or wider. The improved dust-blower keeps the lines of the work free from sawdust. It is claimed the ⅜ inch round belt fits the large double-grooved driving wheel so as to not only drive the saw easily, but also to prevent any slipping or lost motion.

The capacity of the machine is to cut wood up to one inch thick, and a swing of 15 inches between saw and frame. Its weight is 65 pounds. Spindle-spring and bearings are made of tempered steel. In the engraving, *O*, is the blower attached to saw-arm, *M*, a drilling attachment which can be turned up out of the way when not in use, and *N*, an eccentric that tightens the belts to drill.

Fig. 1 is a sectional side view of the machine, showing the table, with the hollow ball and hinge clamp ready for use.

Fig. 2 is a view of the machine, showing the front of hollow ball and clamp.

Fig. 3 is a sectional view of the saw clamp,

Fig. 4 is a view of improved drill chuck.

The table of the machine, with the hollow ball, *C*, is made in one piece, and is held in its place by the clamp, *A*, *B*, in Figs. 1 and 2, which is fitted to the hollow ball, *C*, and by unscrewing the screw, *w*, in Figs. 1 and 2, the table can be tipped to any angle, and in any direction desired for inlaid work, and is held to its place by again screwing up the screw, *w*. The object of this is to saw on a bevel on either side of the saw. The clamp, *A*, *B*, is made with a hinge, *u*, in Fig. 1, with the pin, *x*, to hold the hinge in its proper place.

The saw clamp, Fig. 3, is made on the spindle, of steel, with the hole, *F*, and then slotted, as shown in the drawing, and provided with thumb-screw, *n*, *n*. An adjustable screw, with hole at *E* for the saw, *m*, *m*, to pass through on direct line of centers, holds the saw firmly, and can be removed in an instant by unscrewing the thumb-screw, *u*, and can be replaced in the some time.

The lathe attachment has a hollow ball same as the table, and can be attached to the machine in the same way. It is eighteen inches long, eleven inches between centers, and has four inches swing. It is made of steel and iron.

According to the *Railway Age* fifty new railway companies were incorporated in Illinois alone during the year 1882, aggregating about 3,800 miles in length, most of which will doubtless begin building during 1883. Some of these projects will fall through, and some include portions of lines already built, but making all proper deductions, this record of new organizations in one State in a single year, indicates a prospective activity in railroad building which will astonish many conservative persons.

About one year ago a commercial traveler jokingly agreed, in the event of failing to deliver a lot of machinery within a specified time, to pay for an oyster supper, with the usual accessories, for the mechanical heads of departments of the establishment. Failing by a day or two, he did this, inviting enough outside to make the number a dozen. The evening was so pleasantly passed that a society was organized, comprising those present and eventually other representative mechanics, who now meet regularly for the interchange of mechanical ideas, and the discussion of shop methods, tools and appliances, to the mutual interest and instruction, we are told, of all parties.

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NEW YORK, FEB. 17, 1883.

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Abnormal Hindrance to Business.

The drawbacks which general business is liable to experience any year, such as follow poor crops, drouth, freshets and combinations to control certain products and transportation rates, are in some measure allowed for annually in shaping large commercial ventures. These are, however, temporary in their nature, and their effects, at most, are limited. But the possibility—to say nothing of the probability—of permanently injuring any one of a hundred important industries when the entire revision of the tariff and internal revenue is agitated by Congress, is an abnormal hindrance to general business, the consequences of which are more to be feared than a concentration of all the ordinary evils liable to oppose the progress of trade. While this revision is taking shape, manufacturing interests wait quietly its definite accomplishment, fearing to risk important extensions until the matter is settled either favorably or unfavorably. The worst feature about the process of revision now going on in our National Legislature, is that the end may not be reached during the present session of Congress and that industrial interests may wait with these matters hanging over them in suspense several months longer. We can only hope that such will not be the case. Enough damage has already been done to legitimate business by a few weeks tinkering of tariff and internal revenue duties to warrant more expedition on the part of our lawmakers. Many shops and factories are running on short time with no other reason apparent than the possibility of damaging industrial legislation. It affects all classes of trade adversely. Those establishments coming under the designation "protected industries," so sneeringly applied by the free trade organs, suffer no more than many others that must, per force, share in the abnormal and avoidable depression. It is impossible that any great industry should be depressed without making its influence felt upon other industries. Such a thing as an absolutely "independent" branch of trade does not exist.

What is a Guarantee?

A correspondent who frequently favors the columns of the AMERICAN MACHINIST is exercised with reference to the signification—from a mechanical standpoint rather than from the lexicographer's view—of a "guarantee." It may as well be admitted that it is somewhat puzzling to imagine—not to say determine—exactly what each party to the transaction understands by the term, when one party sells and the other buys, for about $25, some device, under a guarantee to save in the neighborhood of 100 per cent. of the fuel used in an industrial establishment, in connection with the motive plant, for instance. A fair assumption is, however, that the seller expects eventually to perfect the sale, and that the buyer does *not* expect to be humbugged.

We have heretofore had something to say on the effect of extravagant guarantees, but there are generally two sides to a question, and it is perhaps too much to expect that the seller shall take the entire responsibility of initiating revolution in a custom for which, after all, he is only in part responsible. It would perhaps be better if transactions in which guarantees of efficiency are usually exacted and given could be made altogether without them, but it is too much to expect that this will be the case—at least at present. Those interested in paying for the hundreds of economical mechanical arrangements constantly being introduced cannot be expected to be able to judge of their merits, especially when expert engineers are at fault in their judgment, so that the most apparent way for the buyer to protect himself is to exact a guarantee of future performance, more with the idea that a good deal of smoke indicates some fire, than that the full extent of the guarantee will be realized.

If an inventor or manufacturer seeks to introduce novelties in the mechanical line, he can hardly expect to do so in what will seem to him reasonable time, unless he is prepared to offer guarantees sufficient to induce purchasers. As the extent of the guarantee has a good deal to do with the prospects of a sale, it is quite natural, whether or not it is in accordance with the best judgment, that the seller will not at least underestimate the advantages. To this course—overestimating the advantages—he is persuaded not a little by a large class of the buyers of such devices. It is one thing to persuade the user to buy something that will effect a saving of 5 per cent., and quite another thing to persuade him to consent to the removal of something that is already effecting that saving. That the seller will take advantage of the fact that it generally requires 20 per cent. guarantee to place, what 5 per cent. saving will sell, is to be expected. Looked at in this light the average guarantee amounts to an opinion on the part of the seller that the buyer will be well enough satisfied to pay for, rather than consent to the removal of, what he sells, which would be a good way to put the matter in the beginning.

Our correspondent more than intimates his exceptions to the fact that inventors of presumed economical mechanical devices, especially those relating to steam economy, will not consent to receive as pay an amount represented by the proportionate saving effected; that is, less, if the saving is less, and more if it is greater than the guaranteed saving.

This, in theory, would be exact justice, but in practice, unless in exceptional instances, might be very far from justice. In the early days of the automatic engine, Mr. Corliss made contracts embodying these features, in one instance contracting to furnish a pair of engines for the sum of $10,500, or for the saving in fuel for five years. The sale was made on the basis of the fuel saved, and he actually received $19,734.22 for the engines. In another instance the alternative was the forfeiture of one dollar per pound for each pound of coal he failed to save out of a certain specified amount, in which he was also successful. In either instance the cost of determining what the saving was, represented but a small percentage of the price received.

On the other hand, let the matter at issue be, say, a damper regulator worth $50, sold under a guarantee to save 10 per cent, and actually saving 5 per cent. It would cost the seller the price of several damper regulators to demonstrate exactly what it did save, and the transaction could hardly be taken to contemplate an expenditure of $200 on his part for the purpose of receiving $25 or $50 in return. Just how to cover such cases as this, unless the sale is made solely on the grounds of satisfaction, would be as difficult as to persuade the seller to forego the advantage of the seductive influence (on the buyer) of a 50 per cent promise, or to induce the buyer to buy on reasonable presentations. Whoever will reform present practice in selling and buying a good many things not worth rating by actual tests, will confer a favor that will, in time, be appreciated.

Machine Tools.

If for the past year or two the buyers of machine tools have been somewhat troubled in getting their orders filled as promptly as they desired, they have, on the whole, had the satisfaction of getting a better class of work of the kind than ever before. While it might, not unreasonably, have been expected that the abnormal demand would have induced builders, if not to lower the standard of their work, at least to cease any special efforts to advance it, because improvement was scarcely necessary to insure sales, neither has been the case. On the contrary, it is probably a fact that the improvement of the past three years in the construction of machine tools has never been equalled in this country in any corresponding period. If tool builders have received good prices for their work, as they undoubtedly have, they have returned an equivalent in the way of a superior product, sometimes when the increased value was not an essential feature of the sale; in other words, when it was not contemplated in the contract. A liberal percentage of the profits of the best tool builders has gone into improved patterns, and into ways and means for elevating the quality of product, of which the buyer has and will in part reap the benefit. So noticeable have improvements been that they may be seen without particularly critical observation, which is something that both builders and buyers may congratulate themselves upon.

The progress that has already been made should not be taken as indicating the end of progress in this direction, nor that builders are not fully alive to the necessity of future progress. The demand in every branch of the machine business is for something better, and the machine tool builder stands at the beginning of the cheap production of good machinery. When flat or round surfaces are spoken of to-day, the meaning is to be taken literally, not approximately, and the more nearly such surfaces are produced by the cutting tool of the machine, the less will future operations increase their cost. The generating surfaces are those of the machine, and upon their truth and rigidity the results depend.

The demands of electric lighting have had an important influence in bringing out a class of steam engines remarkable for their perfection of workmanship, and their production at reasonable prices has had as much to do in demonstrating the economic difference between good and poor machine tools. The old-time tools that were "good enough" for old-time requirements will not do, not so much because the faulty work produced by them cannot be corrected, as because it costs too much to do so. Hand work is costly when compared with the interest on the investment of a few dollars in good tools. In comparing old times with present times, in these respects, it is necessary to go back but a few years.

Altogether, looking to the probabilities of future demands, and to the temper of current discussion, there is every reason to believe that progress in machine tool construction is only fairly inaugurated.

Rapid Deterioration of Iron in Boilers.

The corrosion of iron in boilers is frequently allowed to go on unnoticed until the sudden collapse of a tube or flue announces the fact that the boiler in its present condition is no longer fit for use. Accordingly the works have to be stopped in order that an examination may be made to ascertain the extent of the needed repairs.

It often occurs that the boiler fails just at a time when the works are driven to their full capacity, and the examination reveals the fact that a number of tubes will have to be replaced by new ones.

An attempt is made at once to find some one upon whom to lay the blame, the engineer being the individual generally selected for that purpose. That does not, however, change or help the existing condition of things in the least. People as a rule are too apt to purchase and use a boiler until it gives out, without once inquiring in regard to its actual condition, or insisting upon periodical inspection of the same.

At the present moment we have a case in mind, where two new flue boilers were purchased and put to work. The water used was rather brackish, but no trouble was apprehended. One day the boilers steamed very badly, and the engineer tried to force the fires, resulting in burning the bottoms of the shells directly over the furnace. A stop of one week was rendered necessary to patch the boilers.

An internal examination revealed the fact that there was a deposit of saline matter, as hard as a rock, so that a cold-chisel and sledge had to be used in removing it. Corrosion had started under this deposit, and had progressed to such an extent that the iron had deteriorated to a dangerous degree in several places. These boilers had stood all they could possibly endure. Careful examinations should be frequently made to ascertain if there are any indications of a

chemical action going on within the boiler. We recently examined several specimens taken from a boiler built by the Babcock & Wilcox Company of this city for the Belmont Cotton Mfg. Company of Sumpter, S. C. This boiler was set new in June, 1881, and failed in November, 1882, by the collapse of a 4-inch tube. Upon examination it was found that the tube, which was originally $\frac{13}{100}$ inch thick, had wasted away, until there was insufficient material left to hold the pressure, when it necessarily gave way. The water glass also was eaten away from an original thickness of $\frac{5}{32}$ inch to $\frac{1}{64}$ inch.

The hand-hole bars and bolts were also badly eaten, the latter being reduced from $\frac{7}{8}$ inch, their original diameter, to $\frac{9}{16}$ inch.

The feed-water pipe was the usual $1\frac{1}{4}$" steam pipe and $\frac{1}{8}$ inch thick, but had in one place been eaten completely off. Had an examination been made at the proper time, and the chemical action discovered, a remedy might have been adopted, which would have stopped it. An examination of the pitted surfaces exhibited unmistakable evidence of the presence of sulphuric acid in the water. This was probably due to the fact that the water, which was pumped from a well, had come in contact with iron pyrites or sulphurous earth.

From this source sulphur would be taken up by the water, and the action of the heat would cause a deposit or coating of sulphide of iron upon the internal surfaces of the boiler, while the acid gradually attacked the iron. The sulphur would form in the boiler a diluted sulphuric acid, which would eventually prove a very destructive agent to the iron. If, when this action was first discovered, a piece of litmus paper had been dipped in the feed water, the presence of acid would probably have been detected.

A better test might be made with paper colored yellow by a solution of turmeric; the paper will readily be turned brown by the presence of any free alkali.

After discovering the causes of the chemical action, a substance can easily be introduced into the boiler which will neutralize the acid or alkali. Soda is a very good substance to be used in neutralizing acids, but should be used sparingly.

Too much care cannot be observed in the examination of boilers to guard against the rapid chemical action that often starts without any apparent cause, and unless arrested would soon destroy the iron. A drop of sulphuric acid upon an iron surface, which has been eaten by sulphuric acid, will liberate carburetted hydrogen so unmistakably that a man who has once smelled it will never forget the odor.

Timely examination, intelligent investigation, and prompt action constitute the most economical course to pursue in such emergencies.

Literary Notes.

The *Industrial Monitor*, Vol. I., No. 1, for January, 1883, is before us. It is a new, bright-looking Chicago monthly, of 16 pages, "devoted to the interests of manufactures, mechanics and railroads." It seems to have the elements of success. H. W. McCune is editor and proprietor, and the subscription price is $2 a year.

The *Cincinnati Artizan* has changed to the quarto form, 16 pages, and comes out in a new dress, much improved. It is published monthly, at the low price of fifty cents a year.

The *American Lumberman* is a new candidate for public favor, published weekly in New Orleans, at $3.50 a year. It is a 24-page sheet, and contains much interesting information to the lumber trade.

The *Denver Journal of Commerce* seems to have a fair share of Western "git-up-and-git." Its merits have so impressed the Colorado State Legislature, that a concurrent resolution recently passed that body to subscribe for a copy for each one of its members.

The *Des Moines Trade Journal* is a new 16-page monthly journal, devoted to the commercial interests of Iowa. It seems to be well edited, and is of value to those interested in Iowa trade and manufactures.

We called recently, in company with C. E. Billings, at Colt's Armory, Hartford, Conn., and are indebted to Mr. Lord and Mr. Accler of these works for courtesies extended in enabling us to witness the operation of the Gatling guns built there. This gun has been greatly improved, and can be readily fired at any elevation. The firing was at the rate of 104 discharges in about two seconds.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(67) A. W., St. John, N. B., asks: Will you please inform me how to copy drawings by the blue process? *A.*—You will find directions in the AMERICAN MACHINIST of Oct. 8, 1881.

(68) A. L. H., Utica, N. Y., asks: How is it that steam can be blown into the tank of a locomotive through a "Mack" injector? *A.*—Injectors for this purpose are supplied with a special device by the use of which this is accomplished.

(69) F. J. H., Howell, Mass., asks: Will you give me a rule by which to figure the dimensions of cone pulleys? *A.*—See the AMERICAN MACHINIST of Aug. 27, Oct. 15 and 22, and Nov. 26, 1881, and Feb. 25, 1882.

(70) H. B., Toronto, Ontario, writes: I have tried to make a paste for polishing articles of ornament on a wheel, but it is either too soft or too hard. I think what I want is the same as is used by jewellers. Can you help me any? *A.*—We should say you wanted crocus, which you can readily buy.

(71) H. P. D., Calvarado, Cal., writes: I have been told by old boiler makers that the reason why a wooden plug driven into a boiler will hold against the pressure is because the end being pointed the pressure has nothing to act against. Is there not just as much pressure on the plug to force it out when pointed as if the end is left square and the full size? *A.*—Yes.

(72) B. M., Springfield, Mass., asks: If a boiler is heated red hot and water pumped into it, will steam be generated at once, or not until the temperature of the iron is reduced? *A.*—It is generally conceded that steam will not be generated rapidly on red hot iron. Some steam, however, would be generated immediately in the instance mentioned.

(73) J. C. K., Meadville, Pa., asks: Please give me the horse power, and also your opinion of an engine of the following dimensions: Cylinder 12"×18"; revolutions 200; steam pressure 80 lbs., cut off at ⅛ stroke. The valve is a double ported slide, with steam ports ⅞"×13" each. The exhaust port is $1\frac{7}{8}$"×13"; width of bridge 1". The size of steam pipe is 4". The speed is controlled by a throttling governor? *A.*—We suppose the engine is run non-condensing, in which case a theoretically perfect engine would indicate about 103 horse power. Practically, we should say the limit to which such an engine should be worked would be about 70 indicated horse power. So far as we can judge from the limited description of the valve, &c., there is nothing wrong except perhaps an excess of steam port.

(74) C. S. B., Minneapolis, Minn., asks: Will you please tell me what should be the width of steam and exhaust ports and bridges, for a cylinder 28"×30", running at 85 revolutions, with 90 lbs. boiler pressure; also what lap, if any, the main valve should have? *A.*—In proportioning the ports of a steam engine many other things besides those mentioned should be known. Speaking in a general way, if the steam ports are, say, 26" in length, we should say that their width should be $2\frac{3}{4}$", and the exhaust port about twice that width. The lap of main valve should be governed, in part, by the kind of cut-off used. With an ordinary riding cut-off about ¾ of an inch lap will work well. The width of bridges may be the same as the thickness of metal in the cylinder.

(75) H. W. B., Harrisburg, Pa., asks: 1. Is the front head of a steam engine cylinder the one in which is the stuffing box, or the plain one? *A.*—In locomotive practice it is customary to call the plain head the front one; in stationary engines the head with the stuffing box is generally called the front head. 2. We have two engines, one 36"×60" running 44 revolutions, with 80 lbs. boiler pressure; the other 25"×60, running 52 revolutions, with same pressure. What is the horse power of each? *A.*—If non-condensing, about 450 and 250 horse power, respectively. If condensing from 20 to 30 per cent. more. 3. We have a steam pump for fire purposes. The suction is 4" and the discharge is two 2½" streams, and through a ¾" nozzle. Is this right? *A.*—We see nothing wrong in the arrangement.

(76) S. E. M., Cincinnati, Ohio, writes: In December last we had a fire in our warehouse, which rusted a large portion of our stock of polished machine screws; many of them are too small to hold against a buffing wheel, or to rub off by hand. Can you prescribe a cheap and effective treatment for the removal of the rust? *A.*—You will have trouble in cleaning the small screws so that they will be of value. You can probably remove the rust by immersing the screws in a mixture of one pint hydrochloric acid to one quart of water, and letting them remain sometime, the exact time to be determined experimentally, after which remove, wash thoroughly and dry. It is questionable, however, if they would be of much value after this treatment. You can try it on a small scale without much trouble.

(77) F. H. L., Keene, N. H., asks: Will you please inform me how I can boil sweet oil? I have tried placing it in a vessel over a fire, but after it became quite hot, but not enough to boil, the oil would take fire. I have also tried placing in a water bath, but with no better result. By giving instructions how I may overcome my present trouble, with a receipt that will produce the desired effect, you will greatly oblige me. *A.*—You do not state the quantity of oil you wish to boil at one time, but from the following you will be enabled to accomplish what you desire. To boil a small quantity of sweet oil place it in a test tube (glass) and hold or suspend it over a spirit lamp. Apply the heat very slowly. To boil a quart or so put the oil in a glass vessel, a pickle jar will do very well, and follow the above directions. For large quantities, it should be put into an iron vessel or kettle with a tube or close-fitting hood to cover the top, for conveying the vapor away either to a chimney, or so far that there will be no danger of its taking fire. It requires about 420° Fahrenheit to boil sweet oil, and care should be observed not to raise the temperature too rapidly, or the oil will be burned. When brought to a boiling point the heat should be carefully regulated.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

James W. See, Consulting Engineer, Hamilton, O. Mechanical Engineer. Complete motive power outfits a specialty. Peter Banta, Cold Spring, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

J. C. Hoadley, Engineer and Expert, 28 State St., Room 28, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Table for screw-heads and tap-drills. Price, 10c. and 3c. stamp E. E. O'Daniels, Athol, Mass.

Consulting Engineer and Mechanical expert, C. C. Hill, Room 8, Ulich Block, Chicago, Ill.

Machine designing and general engineering work, T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

Lyman's special high Odontograph Scale runs to 8-inch pitch. Price 25 cts. E. Lyman, C. E., New Haven, Conn.

A handsome monthly journal sent free to engineers and mechanics the year round. Send postal for it to Money Saver, 95 Liberty street, New York.

Steel Forgings, either plain or crank, up to 10,000 lbs. in weight. Address, Pennsylvania Steel Co., 160 Broadway, New York.

Light and fine interchangeable machinery to order. Foot and power lathes, slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N.J.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

Boring Bars made all sizes for all purposes to bore both straight and taper work. Pedrick & Ayer, proprietors, L. B. Flanders' Machine Works, 1025 Hamilton street, Philadelphia, Pa.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

The *Sanitary Engineer* of January 25, contains an illustrated description of the work of the New York Steam Heating Company, the largest enterprise of its kind in the world. Sold by news dealers; 7 cts., weekly.

MANUFACTURES.

Scherpe, Koken & Graydon, St. Louis, Mo., will soon build an addition to their iron foundry.

A Pittsburgh manufacturer is experimenting with annealing glass blocks for building purposes.

A. H. Lowell, Manchester, N. H., is building an addition to his foundry building 40x80 feet, three stories.

Clapp & Company, Concord, N. H., have just moved into their new foundry building, 131x50 feet. They melt three times a week.

New wire mills are building at Detroit, Mich., Joliet, Ill., Syracuse, N. Y., Beaver Falls, Pa., and other places both East and West.

The Greenmanville factory and the Standard Machine Company, at Mystic, Conn., have been putting in new power and preparing for more business.

A new Chicago establishment is that of J. M. Long & Co., 186 Quincy street, brass and iron founders and finishers. Brass fitting for steam, gas and water work, will be a specialty.

The Marshall, Texas, Car and Foundry Company have for the present abandoned the erection of a blast furnace at Marshall and have purchased from Horace Ware the furnace near Kellyville.

The American Direct Iron and Steel Company, whose works are located near Pittsburgh, Pa., claim to be able to make iron at a cost not exceeding $6 per ton, outside of the cost of the ore.

The city authorites at Marshalltown, Iowa, exempt from municipal tax all manufacturing establishments for five years, and supply from the city water works all water needed by them at cost of pumping.

The total incorporated capital of the 15 cotton factories in the State of Maine is $10,840,000, and of the 14 woolen factories $2,124,000. Besides these there are numerous other woolen mills owned in a private capacity.

Fraser & Chalmers, of Chicago, have now completed the new large additions to their shops. Their foundry is 145x150 feet; machine shops, 150x210 feet; boiler shop, 175x120 feet; blacksmith and erecting shops, 150x100.

The Valley Iron Works, at Appleton, Wis., are putting into their new buildings, now completed, the latest improved machinery, and are working with a full force of hands. Their buildings are 112x40, two stories.

The Lynn Electric Light Company, of Lynn, Mass., will occupy a new three-story brick factory to be built back of the Lynn Hotel. The establishment will produce electric lighting apparatus, and 100 men will be employed.—*Manufacturers' Record.*

An effort is being made to prevail upon the Davis Sewing Machine Company, of Watertown, N. Y., to move to Syracuse. The company is not satisfied with its shipping facilities. Jacob Crouse has offered the company a building site in Syracuse.

The Duggan-Parker Hardware Company of St. Louis, recently burned out, will proceed at once to build new works to employ 300 men. The buildings will cover nearly an acre of ground and are expected to be ready in three or four weeks.

The Saco Water Power Machine Shop, at Biddeford, Me., are building a large portion of the machinery for the King Mill at Augusta, Ga., also for a mill in Montreal. At present the works are being run to their full capacity, giving employment to over 500 hands.

At Chartiers, Pa., Anderson, Dupuy & Company, will probably complete their new steel works in the course of a month and will produce bar, spring, and hammered steel and boiler plate like the Pittsburgh Steel Works, of which it is understood they take the place.

The new steel works at Wheeling, W. Va., will contain three eight ton converters, five cupola furnaces, and one blooming mill with a capacity of 800 tons per day. There will be fifteen heating furnaces employed. The gross amount of steel to be turned out in a year is estimated at 120,000 tons.

The Billings & Spencer Co., Hartford, Conn., have put in automatic sprinklers with 280 points of opening in their works, also a Worthington fire pump. Two tanks holding, together, 30,000 gallons are kept filled just outside the engine room. With these precautions it is believed a fire cannot make much headway.

Berton & Nickel, 422 East 23d street, New York, agents of the Jarvis Furnace Co., have received an order from the Bordentown Water Works, Bordentown, N. J., to set a boiler with the Jarvis furnace. Among other recent orders for this furnace is one from Crown Mills, Belleville, Ill., for three boilers, and one from L. Richardson & Co., Louisville, Ky.

The Western Brass Works have recently sold and transferred their entire business to the Western Brass Manufacturing Company, a newly organized concern consisting of Mr. James Jones, president (late of the Western Brass Works); J. C. Wilson, vice-president (late with N. O. Nelson), and W. E. Althus, secretary and treasurer (late with Siegel & Bobb and Becannon & Co.) The new company will carry on the business of the old one with increased facilities and without change of location.—St. Louis *Age of Steel.*

Rundle, Spence & Co., of Milwaukee, are fitting up the new shops for the C. M. & St. Paul Railroad Co., at Minneapolis, Minn.

B. F. Kelly, 20 Cortlandt street, New York, has sold eighteen Baragwanath feed water heaters since October 1, 1872. He reports orders increasing.

P. V. Carbine, Madison, Ala., has established a machine shop, fully supplied with the requisite machinery and tools for repairing steam engines and other machinery.

The Pratt & Whitney Company, Hartford, Conn., are now employing 675 men, and have no trouble in finding plenty of work to keep them all busy on full time.

Armington & Sims, Providence, R. I., have recently shipped engines to Italy, Chili, Amsterdam, Holland and have just received an order for three more from Italy. They have just shipped two to the Edison Central Station, New York City.

The Globe Iron Works Company, of San Francisco, have incorporated for the purpose of engaging in a general foundry business, but more particularly with the view of manufacturing mining machinery. F. B. Bacon is president.

David W. Pond, Worcester, Mass., has sold his business, the manufacturing of iron working machinery, to the Pond Machine Tool Company of that city. The business will be under the same management as heretofore. David W. Pond is president, and Albert C. Stebbins treasurer of the new company.

The Great Western Manufacturing Company, Leavenworth, Kansas, announces by circular that although their machine shops and wood working department were destroyed by fire, their office, warehouse and foundry were preserved intact with their entire contents, including patterns. They have made arrangements by which their business will go uninterruptedly in all departments.

The Lidgerwood Manufacturing Company, 96 Liberty street, New York, have appointed J. H. Houghton general eastern selling agent for the sale of Lidgerwood engines. Mr. Houghton was for a number of years superintendent for Kendall & Roberts, Cambridgeport, Mass., which position he resigned to accept the one to which he has just been appointed. He will immediately open a store in Boston, where a full line of Lidgerwood engines will be kept in stock.

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 1, 1883.

This week orders for supplies are coming in more freely, and the dealers begin to exhibit a disposition to be contented with the business prospects for the present year. There are already indications of a good spring trade, and active inquiries are being made by buyers with a view of placing early orders.

Cooke & Co., 12 Cortlandt street, New York, selling agents for the Roots' Rotary Blowers, send us the following circular, which explains itself: "During the past few months there has been no perceptible falling off in the demand for Roots' Rotary Blowers. Their merits are becoming better appreciated each year, and the greatest difficulty now experienced is to keep the supply equal to the demand."

The Lambertville Iron Works, Lambertville, N. J., have just issued a new illustrated catalogue, containing 30 pages, well filled with matter pertaining to their automatic cut-off steam engine. This pamphlet also contains neat engravings of complete views and details of their engine as well as numerous diagrams and other matter of general interest to the engineer and steam user.

Iron and Metal Review.

The past week has developed nothing new in the Pig Iron market. There is unmistakably an inclination on the part of consumers to wait until matters in Washington pertaining to the tariff are settled.

Meanwhile business moves on in the now well-worn channel. All sales made are at concessions, being composed almost entirely of small lots. There seems to be very little inquiry for future delivery.

We quote prices as follows: Foundry, No. 1, $25 to $25.50. Foundry, No. 2, X, $22.50 to $23.50. Grey Forge, $19 to $20.

There has been considerable Foreign iron sold during the past few weeks at concessions obtained through the existing low ocean freights.

We quote Coltness at $25 to $25.50; Glengarnock, $22.25 to $22.50; Gartsherrie, $24.50 to $25; Summerlee, $24 to $24.50; Carnbroe, $22; Eglinton, $21 to $21.50; Langloan, $25.50.

Wrought Iron Scrap is dull at $27, for prime selected from yard, and $26 to $26.50, ex ship.

Steel Rails continue the same as last reported.

Iron Rails, both new and also old remain unchanged.

The Copper market continues quiet with sales of small proportions. Baltimore is quoted at 16¼c., while Western brands are sold at 16⅝c. to 16¾c.

Spelter is in moderate demand at 4¾c. to 4¾c. for Common Domestic, 5c. to 5¼c. for Refined, and 5c. to 5¼c. for Silesian. Tin is in slow demand at 22¼c. to 22½c. for Banca; 21¼c. for Straits and Malacca, 21⅝c. for Billiton and Australian. 22¼c. for English Lamb and Flag. Lead continues in moderate demand at, 4.70c. to 4.75c.; Refined, 4.75 to 4.80c; Antimony, Hallett's, 10¼c. to 10½c.; Cookson's, 11c. to 11¼c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Draughtsman experienced on engine work, desires engagement. Address, K, BOX 3, AM. MACH.

Experienced draughtsman on machine work, wants engagement. Address, BOX 10, AM. MACH'T.

Situation Wanted by a mechanic well experienced on Hydraulic Work. Address, J. E. Barrett, 131 Spruce St., Wilmington, Del.

Wanted—A good man to act as foreman in a brass shop, manufacturing specialties. Address, James Jenks, Detroit, Mich.

Wanted—Situation as machinery pattern-maker or designer. Send business card, state wages paid good workmen, cost of board and probable length of employment. P. Maker, Box 191, Auburn, Me.

Wanted—A man thoroughly competent to take charge of our cost and time accounts. Must have had experience in large shops. Address, with reference, the Hartford Engineering Co., Hartford, Ct.

Wanted—A man accustomed to traveling and taking orders. Must have a general knowledge of steam engines and appliances. Apply personally or by letter with experience and references. U. S. Metallic Packing Co., 1011 South 13th street, Philadelphia, Pa.

Draughtsman of theoretical knowledge, and long practical experience in the construction of marine and stationary engines, sugar plantation machinery and general mill work, is open for engagement; will go anywhere for a reasonable salary, where engineering is wanted. Address, Draughtsman, AM. MACHINIST.

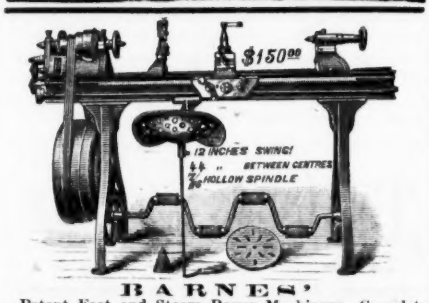
Wanted—An experienced draughtsman, who must be a graduate of Polytechnic School with considerable experience in actual practice. To be employed under Mr. A. H. Emery in designing and constructing the Emery scales, gauges and testing machines. All applications must be by letter only, stating age, experience, references and compensation expected. Personal interviews will be appointed later. Address, the Yale Lock Mfg. Co., Stamford, Conn.

Wanted—Engine builders in need of a first-class automatic cut-off, apply to patentee for photo. and particulars. F. B. Rice, Dunkirk, N. Y.

Two Berryman Pat. Feed Water Heaters for Sale Cheap. Are in good order. Benj. F. Kelley, 20 Cortlandt Street. New York.

Wanted—Complete set drawings or patterns of an improved bolt cutter. Write, giving price, etc., etc., Bolt Cutter, care AMERICAN MACHINIST, 96 Fulton street, New York.

HOW TO KEEP BOILERS CLEAN
FREE Book Sent To Any Address
By JAS. F. HOTCHKISS, 84 John St. N.Y.



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Patent Foot and Steam Power Machinery. Complete outfits for Actual Work-shop Business. Lathes for Wood or Metal. Circular Saws, Formers, Mortisers, Tenoners, etc., etc. Machines on trial if desired. Descriptive Catalogue and Price List free.
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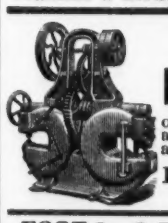
Gage's Self-Tightening DRILL CHUCK
No key or wrench required.
Holds from 0 to 1 1-2 in. L. B. Russell, 96 1-2 Summer St., Boston, Mass. S. A. SMITH, Agent for the West, 154 Lake Street, Chicago, Ill.

TAPS & DIES · VISES · TWIST DRILLS · CHUCKS · TOOLS · MACHINE SCREWS · LATHES · FILES · STEEL TOOLS & STUBS
TOOLS for Machinists, Amateurs, Jewellers, Model Makers, Blacksmiths, Carpenters, Coachmakers, etc.
Send 15 cts. for new Metal Worker's Catalogue, 300 Pages. Wood Worker's Catalogue free.
TALLMAN & McFADDEN, 607 Market St., Philad'a.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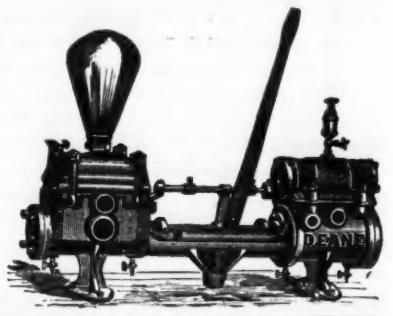
of beautiful design, of great strength and capacity, and thoroughly reliable, address
Lambertville Iron Works,
LAMBERTVILLE, N. J.

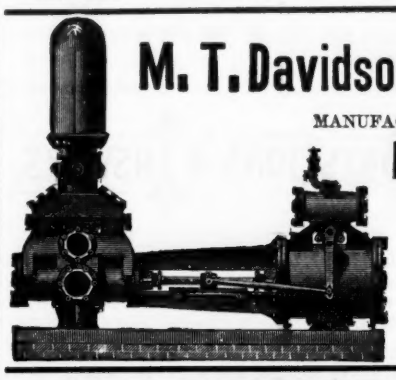
FOOT Bench Power LATHES New Construction Improved Foot Power and Slide Rest.
Narragansett Machine Co., Providence, R. I.

THE BRAYTON PETROLEUM ENGINE CO.
50 Federal St.
BOSTON, MASS.

No Boiler. No Coal. No Steam. No Ashes. No extra Insurance. No Engineer. No Danger. No Explosion. No Fires. Almost no Attendance.
SAFETY! ECONOMY! CONVENIENCE!
Expense Ceases when Engine is Stopped.
When power is required at intervals it is the cheapest Motor known.

"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.
Send for New Illustrated Catalogue.
The Deane Steam Pump Co.
HOLYOKE, MASS.
92 & 94 Liberty St., NEW YORK. 54 Oliver St. BOSTON. 226 & 228 Lake St. CHICAGO.

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MANUFACTURED BY
Davidson Steam Pump Co.,
OFFICE & WORKS:
41 to 47 KEAP STREET, BROOKLYN, N. Y.
Warranted the Best Pump made for all Situations.
KELLY & LUDWIG, Agents,
49 & 51 North 7th St., Philadelphia.

H. W. JOHNS' ASBESTOS STEAM PACKING
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE.
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Car Wheel "	Plumbers' Supplies.
Chain "	R. R. Supplies.
Cutlery "	Rolling Mills.
Coppersmiths.	Safe Manufacturers.
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Mailed on receipt of Price, $3.00.
FARLEY, PAUL & BAKER, Philadelphia.

S. ASHTON HAND,
Toughkenamon, Chester Co., Pa.,
MAKER OF
First-Class Engine Lathes
Is now in position to put on the market
14" ENGINE LATHES OF NEW DESIGN
guaranteed to be equal in material, design and workmanship to the best ever offered.

Extra Heavy 16 inch HAND LATHES.
Built by FAY & SCOTT, Machine Tool Builders.
DEXTER, Me.
Send for description.

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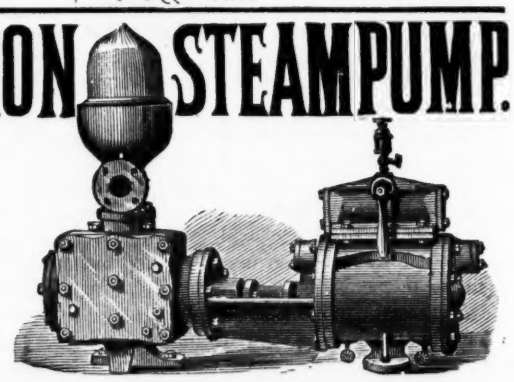
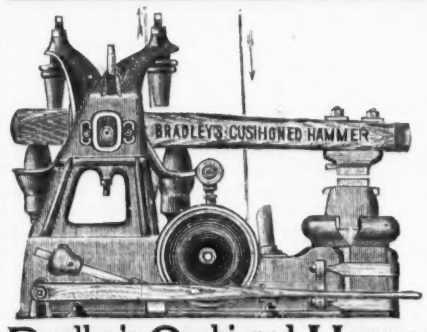
Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON STEAM PUMP WORKS,
Foot of East 23d Street, New York.





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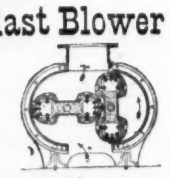
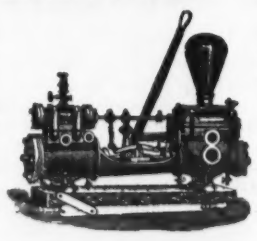
Stands to-day WITHOUT AN EQUAL.
OVER 700 IN USE.
BRADLEY & CO., Syracuse, N. Y.
ESTABLISHED IN 1832.

ROOTS' Improved Force Blast Blower

(Outside view.)


(Inside view.)
Is perfectly balanced, more simple in design and requires less power than any other.
COOKE & CO.,
12 Cortlandt Street, New York,
SELLING AGENTS.
Blacksmiths' Hand Blowers. Portable Forges, Tuyere Irons, and Gas Exhausters.
Please send for circular and state that you saw the advertisement in this paper.

Knowles' Improved Steam Pumps,
THE STANDARD!
Steam Pumps for Every Possible Service.
SEND FOR ILLUSTRATED CATALOGUE.
KNOWLES STEAM PUMP WORKS,
86 Liberty Street, NEW YORK. | 44 Washington Street, BOSTON.



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Save your Boilers FROM DANGER OF Overpressure!

THE CONSOLIDATED SAFETY-VALVE COMPANY,

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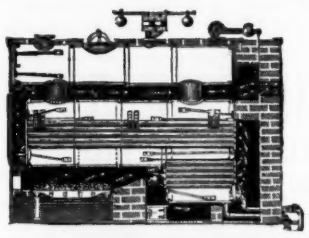
Patent Nickel-Seated "Pop" Safety Valve.

The Only Perfect Safety-Valve made. Approved by the U. S. Board of Supervising Inspectors. For Stationary, Locomotive, Marine, and Portable Steam Boilers. Our Patents cover all Safety-Valves utilizing the recoil action of steam, and familiarly known as "Pop" Safety-Valve. ☞ Purchasers beware of infringements of our patents. SEND FOR DESCRIPTIVE CIRCULAR.

Salesrooms, 111 Liberty St., New York.

Manufactory, 51 & 53 Sudbury St., Boston.



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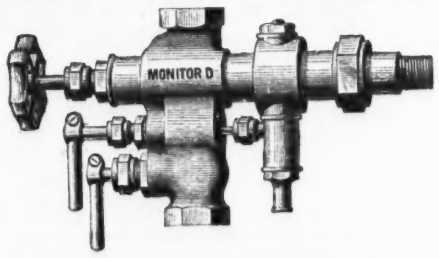

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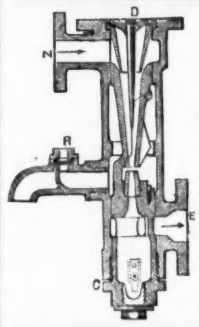

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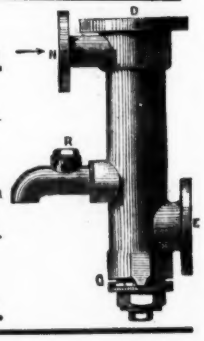

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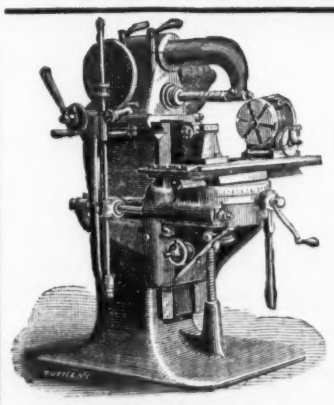

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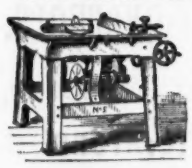

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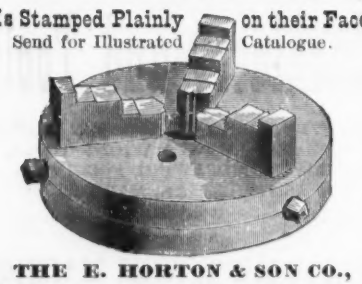

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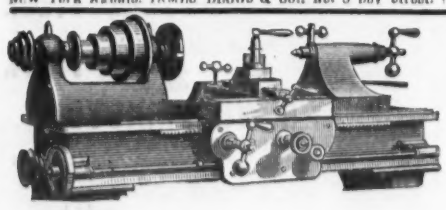

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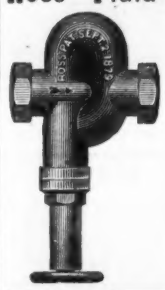

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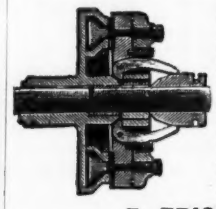

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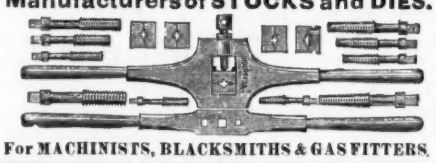

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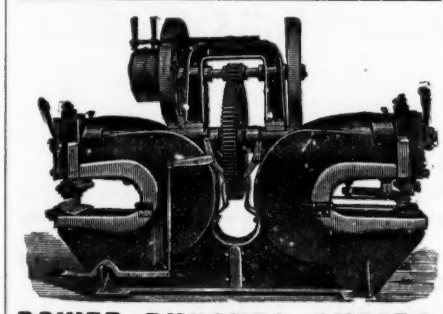

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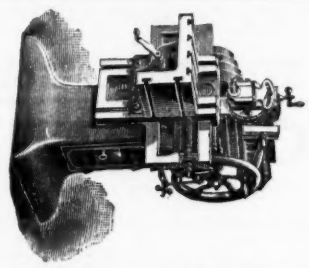

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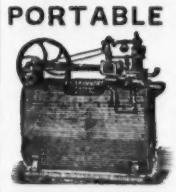

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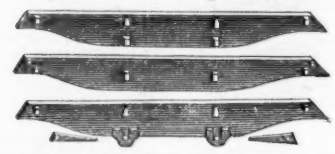

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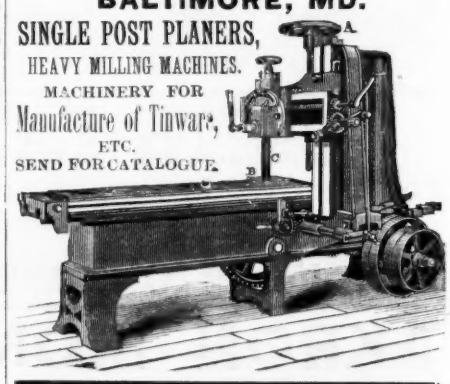

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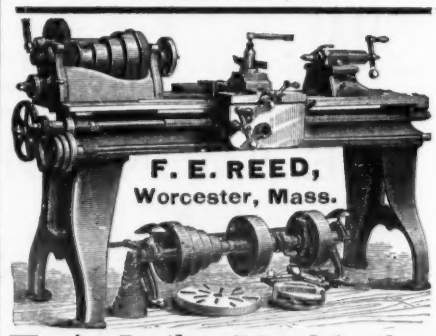

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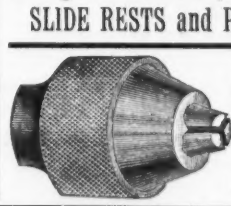

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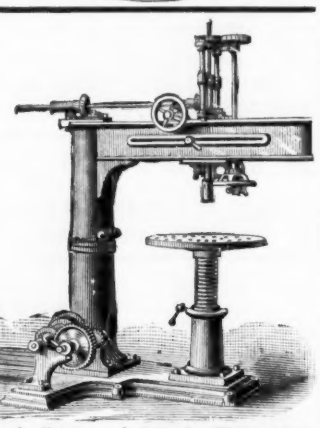

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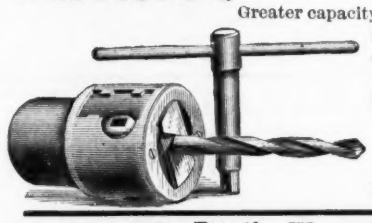

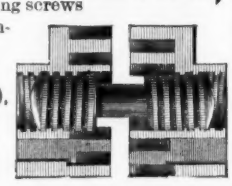

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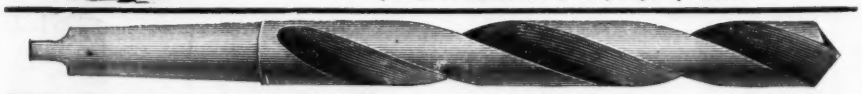

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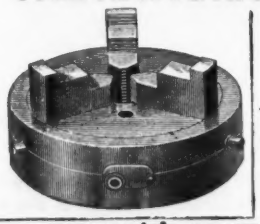

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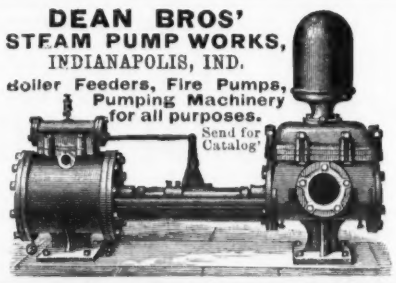

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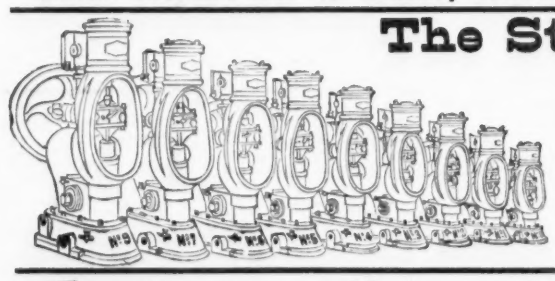

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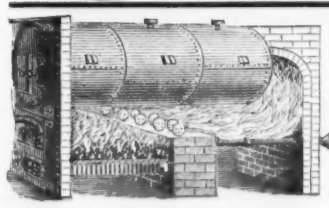

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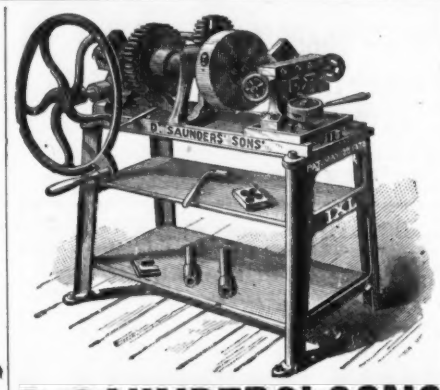

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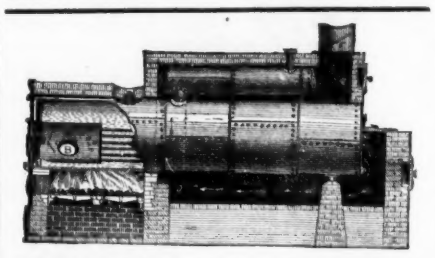

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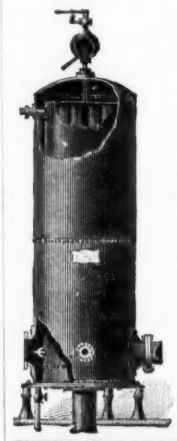

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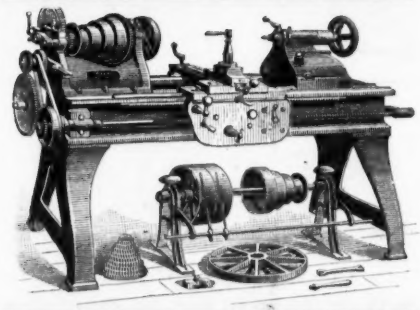

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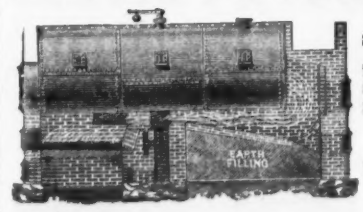

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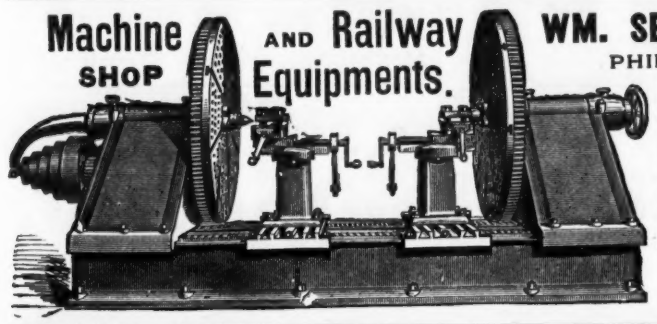

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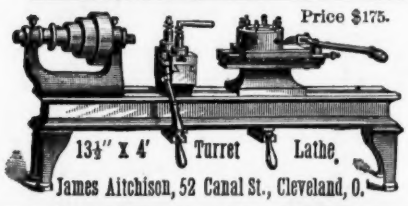

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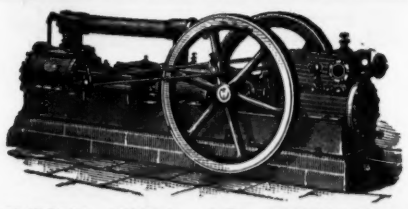

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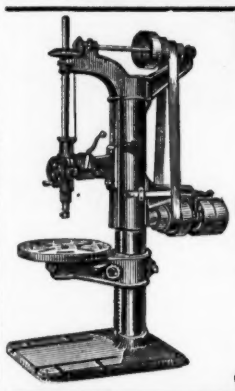

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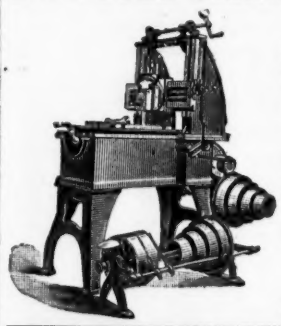

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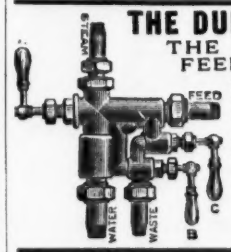

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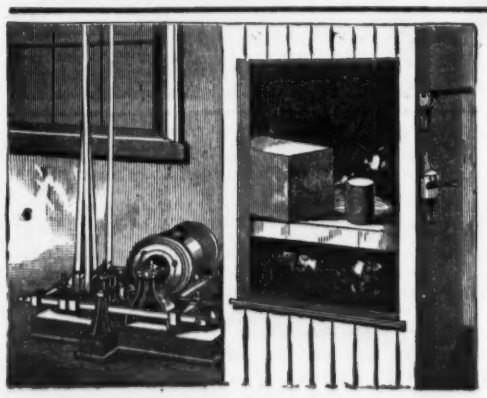

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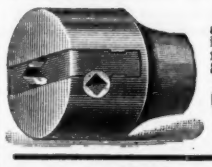

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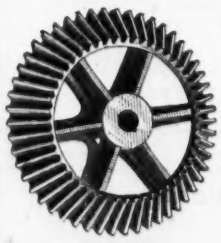

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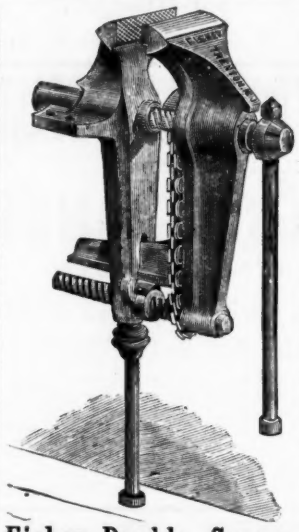

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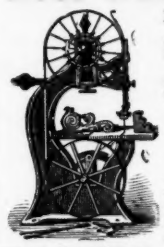

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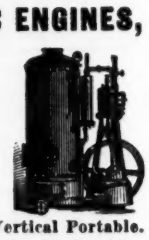

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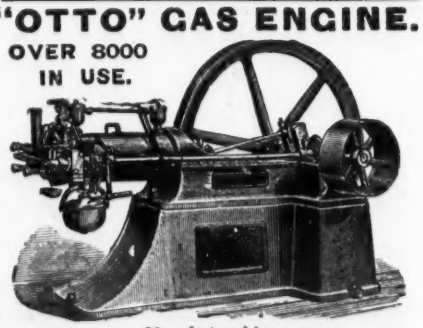

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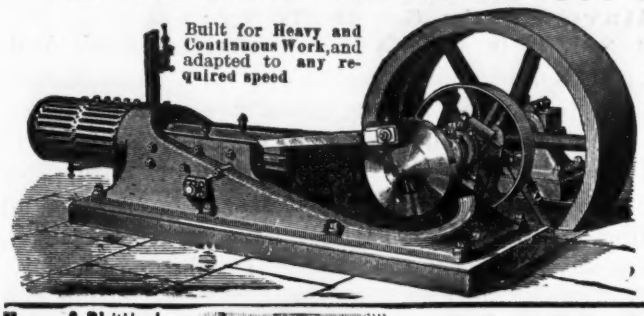

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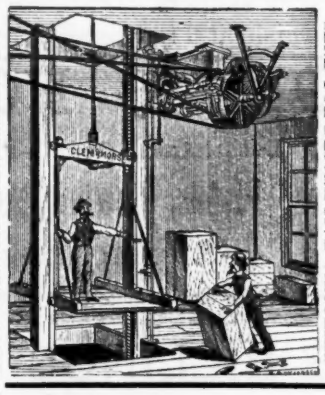

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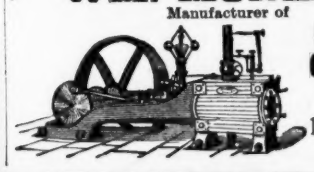

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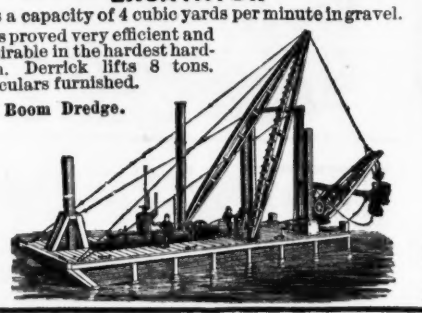

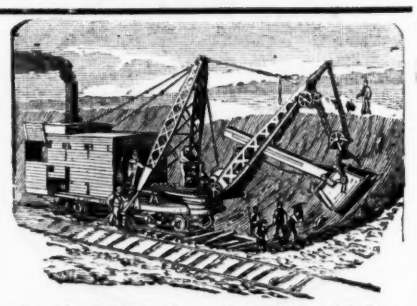

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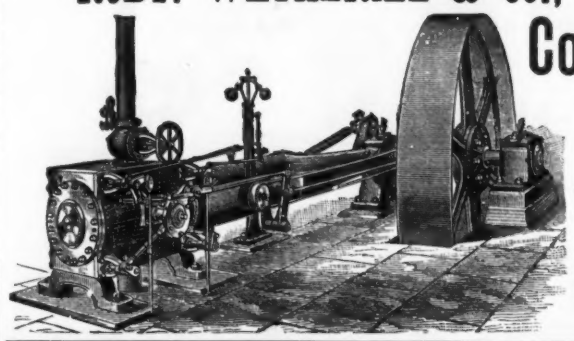

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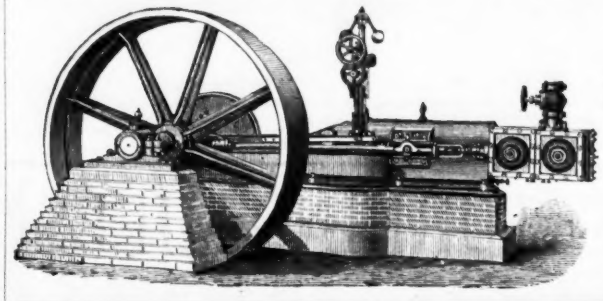

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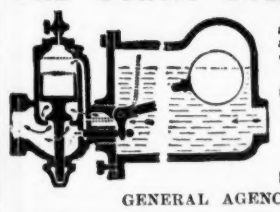

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1 " " 28 in. x 16 ft. New.
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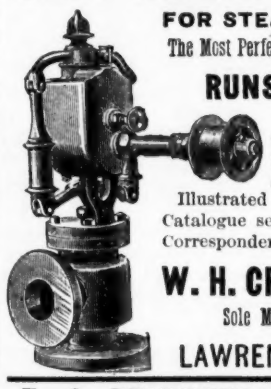

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1 19 in " 10 ft. " " "
1 19 in " 8 ft. " " "
6 18 in. " 8 ft. " " "
5 15 in. " 6 ft. " " "
1 10 in. " 5 ft. " " "
1 30 in. " 12½ ft. " " "
1 26 in. swing, 14 ft. bed. " " "
1 12 in. swing, 6 ft. Hand Lathe.
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1 32 in. x 8 ft. " " "
1 26 in. x 6 ft. " " "
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2 22 in. x 4 ft. " " "
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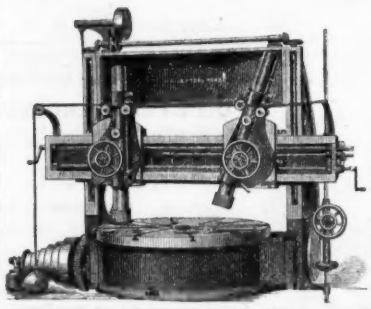

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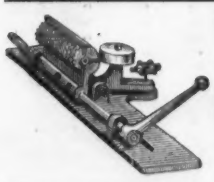

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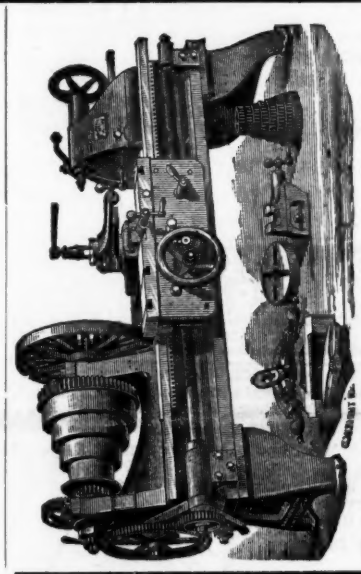

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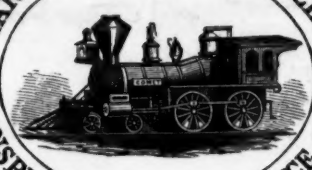

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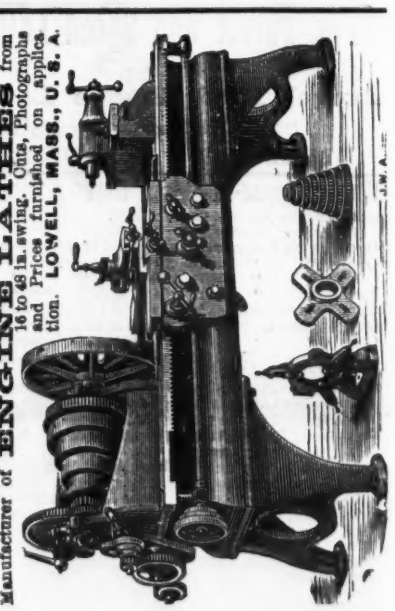

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